

SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1938.—VOL. XLII.]

LONDON, SATURDAY, OCTOBER 12, 1872.

{ PRICE.....FIVEPENCE.
{ PER ANNUM, BY POST, £1 4s

Original Correspondence.

THE EXPLOSION AT MORLEY MAIN COLLIERY.

A fearful explosion of gas at Morley Main Colliery, near Leeds, occurred on Monday afternoon; and, hastening there with thousands of others, only to see the most harrowing scenes which occasionally befall our colliery neighbours, and by which 34 lives have been sacrificed, and many more severely injured, some to be feared fatally, and others maimed and crippled for life, I have drawn up the following accurate particulars for publication in the *Mining Journal*:—

Morley Main Colliery is situated on a very bluff eminence near to the London and North-Western Railway Station, being connected therewith by an incline. The proprietors are Messrs. Wm. Ackroyd Brothers, and such a calamity has never before occurred in the immediate neighbourhood. Some 400 to 500 men and boys are employed at the workings, of which there are three—that in which the explosion occurred being called the deep pit, although the shaft is only 150 yards down, but it has very extensive workings. It runs in a northerly direction under the town of Morley for a distance of nearly a mile, and the part in which it occurred was recently opened, called "Andrews," and not in the old working, where gas usually accumulates, and the seam of coal worked is called the Middleton, being about 4 ft. wide, and on this occasion from 40 to 50 men and boys, with horses, were actively engaged at work when death stalked in amongst them, and cut down so many, and had it not been Monday many more, who these good times keep holiday that day, would have been there. The pit has never been considered dangerous, but Davy lamps are used, and blasting is said to have been allowed under the directions of the deputies. Many are the conjectures as to the cause, some pointing to this blasting—as two of the men taken to Leeds Infirmary were very badly shattered, as though they had been blown along the roadway, and have since died, looked suspicious. The presence of match-boxes and pipes in the possession of the dead bodies, the incautious use of which may have caused the sad catastrophe, but nothing definite has yet come to light to make any safe estimate, and the managers are very reticent until full enquiry is made, which will be at an adjourned inquest. The explosion occurred about 2 P.M. on Monday, but it was not known to the banksmen until some of the men not far from the pit's mouth came to be drawn up. These had perceived a change in the air current, and then ran as for bare life, for they knew that by the suck that an explosion had happened, as they were overtaken by a cloud, and a very dense one, of dust. Their statements were received with incredulity on the bank, but a few moments removed all doubt. There were signs, speaking volumes to experienced men, that a catastrophe had taken place, and no time was lost in getting volunteers, foremost of whom were Messrs. W. Ackroyd, jun., and John Simpkin, head steward, and others from adjoining collieries.

Mr. Wardell, the Government Inspector, also arrived during the night, and at once went down to superintend and take all possible precautions, and as one after another were brought to bank the scenes were harrowing in the extreme, as the mangled bodies were wrapt up, put in carts, and taken to the hotel or to their homes; and it was not till Tuesday, at 1 o'clock P.M., that all but a poor lad was believed then to be missing. Every care and attention was given to those who yet lingered on by the medical men, restoratives being applied, and every means used to alleviate their sad distress.

Mr. TAYLOR, the district coroner, commenced at inquest at 2 P.M., at the Royal Hotel, Morley, where 24 of the dead bodies were laid in rows in a long room—a ghastly spectacle—many of whom looked as though they had gone to sleep, others badly bruised and burnt, and two of them were blackened to a fearful degree, and bruised. After evidence as to identity was given by relatives and others, the enquiry was adjourned at 6 P.M., to visit others in the morning at a distance.

The following is the principal evidence given at the inquest:—
WILLIAM HENRY BUTTERFIELD, filler, deposed that he volunteered down the colliery, and went up jig to top, and found James Butterfield and other two bodies in a hole, with some coals in front of them. Found lamp, with light out, on ground, all right. One body was lying on face, another on side, and the other face downward. Found overthrow blown down at bottom of jig. Used sheeting before getting up jig.

ANTHONY BOWER, miner, of Gildersome, heard alarm, and went to volunteer down: went on to bottom of new drift. Then saw coaxes of coals upset, about 1/2 mile from shaft. First saw a horse dead on roadway: went then to first ending, left hand side, and saw more horses dead, with wagons. No signs of life. Then saw body of Henry Townsend near a horse, as though he had fallen astride over it; but did not appear much burnt. Found two more, one in a hole, another near jig, by wheel. Air not then good. Passed a place where overthrow was blown down, and air was then very bad. Took bodies out: returned and hung sheets to draw air-current. Went up a drift with underground manager and others. Found air very bad, but not much gas. Turned to right, and found three more dead bodies. Michael Rowe on an ending, laid on his face, dead. Face burnt, hips swollen, lamp near, all right. J. Armistage on side, with head on arm; lamp near, all right. Another man, unknown to me; saw something in his right hand; loosened it, and found it to be an ordinary chip-wood matchbox, with no matches in it; nor did I see any near that I could observe. By a JURYMAN: No appearance of any having been ignited, and never examined his pockets, but gave the box to a person near to keep, if wanted to be seen. The man had on only light drawers, and appeared very black, and burnt. Nothing upset about him, but his lamp was about 6 yards further off, as if blown from him.

COAL-CUTTING BY MACHINERY.

Amongst the earliest patentees of coal-cutting machinery the name of Mr. JOSEPH ROTHERY will be remembered, and amongst the latest patents obtained for this class of machinery the name again appears, the advantage claimed for the present arrangement being that the cutters are well adapted to cut either one or both sides in a narrow driving without leaving in a long circular corner, as is the case with the pick machine or any other machine yet made. Mr. Rothery states that it has long been known that the best means of cutting coal is by circular saws, but such large saws are required to get in any depth that they are rendered impracticable; but that by this cutter a rectangular hole can be cut any depth, which would be better adapted to receive the hydraulic wedge in case of getting the coal down by that power instead of blasting; or that by it a very narrow vertical cut may be made behind the jud or buttock, loosening the coal behind as well as underneath. In answer to the statement that the work done by this class of machine—holing—forms but one-tenth

of the whole labour of the collier, Mr. Rothery says that a machine on the principle of his can be made to hole, to cut the sides in straight work or headings, and to assist in getting down the coal as well.

The object of the first part of the invention of Messrs. J. and A. Rothery, of Waterloo Main Colliery, Leeds, is the cutting of a much narrower groove than has heretofore been found practicable by continuous revolving or rotary cutters, whereby the power required is considerably reduced, and less waste of the coal or other mineral is effected. According to one arrangement they use an endless chain-saw, the several links of which are composed of saw-blade metal, and all of them have saw-teeth formed on their outer edges. This endless-chain saw makes a groove of about 1/2 in. in width, and is curved round a small carrier pulley situated between the end of two steel plates, forming a jib, which are connected at the opposite end to the carriage of the machine. At the carriage end of and between these two steel plates is a chain driving wheel, the periphery of which is recessed to receive some of the links of the chain-saw. According to another arrangement they propose to combine two parallel disc saws, or other revolving cutters, with a combined driving and cutting chain situated between them. The parallel circular saws are made fast to the outer end of the axis of a chain pulley, which revolves between them. In this arrangement the chain performs the double function of rotating the circular saws or cutters, and of cleaning out the groove as fast as it is made by them. The chain is actuated either by hand or by power, as is well understood in connection with this class of machinery. The claim is for the improvements generally, the inventors desiring it to be understood that the mechanical details apart from the purposes of the invention are not claimed as being new.

DRAINAGE OF THE SOUTH STAFFORDSHIRE COAL FIELD.

We are much mistaken if the men of South Staffordshire and East Worcestershire have not begun a work that will be attended with great success. Such a large gathering of iron and coal masters as that which assembled in Wolverhampton last week could be brought together only by an amount of interest in the movement most unusual. It cannot be concealed that there were men present who were quite unable to see that their property should be embraced in the operation of any comprehensive system. They had come to the meeting to hear what might be said, but they had come prepared also to go away and maintain their existing isolated position. Why should they do otherwise? They had completed their arrangements, and they were so carrying them out that they were draining their own property, and were disposing of the water without injury to their neighbours. Moreover they were doing this at a cost to themselves lower than that which would be entailed if they had to form part of one united whole, for whom the pumping was done either by a joint-stock company or by a commission. They did not believe in all the minerals being raised for a rate of only 1d. per ton. But men of this class were the exception to the rule. Between them and those who went wholly for a compulsory system there were several who were ready to concur with any measure that might fairly commend itself to the minds of all as the best for the district as a whole, assured that in the long run if the district should be benefited they too would profit. We write with a tolerable knowledge of the views entertained by the mass of the gentlemen who constituted the meeting, and we are happy to express it as our conviction that a more generally honest desire to do the best could not be looked for at any similar meeting anywhere.

When all the different interests assemble in committee it will be seen what it is possible to do. Mr. HARTLEY is a past chairman of the iron trade of the district, is at the head of the firm of G. B. THORNECROFT and Co., and was a member of the last Coal Commission. He, it is clear, believes—indeed, has so reported to Government—that there are "vast treasures" locked up by the water in the mines of South Staffordshire, and nothing but a compulsory enactment, compelling the drainage, *pro rata*, will enable that treasure to be released and made available to the nation. The House of Commons is very conservative of vested interests, but the tone of recent legislation is conclusive as to the views that our legislators entertain in respect of the mineral wealth of the country; and backed, as the House would be, by every consumer of coal and iron throughout the Birmingham and the Staffordshire districts, it points to a tolerably free handling of the question in St. Stephens. It seems evident that the Chairman of the meeting leans to the division of the whole district into separate localities, drained by separate associations; and his speech, showing how he has conferred with Mr. E. B. MARTEN at intervals, for many years past, demonstrates the interest that he has taken in the subject. Whether, however, it shall be done by separate associations of the class to which the association at Old Hill belongs, or whether it shall be done as a whole by one corporation, made up of commissioners, or by a joint-stock company, Mr. BARKER's own experience leaves him no room to doubt that voluntary compacts for draining mineral property break down in actual work.

The report of Mr. JOHNSON and Mr. PEACOCK is a sensible and a comprehensive document, one well fitted to lay the whole question before the trade, but one amenable, as was no doubt intended, to revision and modification. Mr. PEACOCK and Mr. JOHNSON have had considerable experience in respect of individual "pounds," and the figures at the end of their report as to the immensely greater quantity of water than coal raised at some collieries, together with the statement of Mr. UNDERHILL, that some of the South Staffordshire colliery proprietors pay 1s. 6d. per ton of minerals for pumping, show how grievous is the burden which some collieries have to bear on account of the water in their mines. At the same time the Chairman is quite right in his remarks that the district seems to point out certain divisions as naturally inviting to sub-divisions of labour in any great scheme, or failing such a method then separate organisations upon the joint-stock principle, as at Old Hill, before quoted. Certainly it will not be easy to persuade Cannock Chase to come under one comprehensive scheme. There they coffer off most of their water as they go down, and their pumping expenses are, of their water, only a fraction of a penny per ton of coal raised. But the whole subject is now fairly in the hands of the colliery proprietors and colliery workers of the district, and when everybody has been consulted who is able to render valuable assistance, we are satisfied that the good sense of the district will devise a plan of grap-

pling with the difficulty in such a way as shall advantage greatly alike the owners and the consumers of the minerals.

Since the above was written, a meeting of the committee has been held. They have resolved to go to Parliament for an Act, to be worked, not by a joint-stock committee, but by a board of commissioners; they have appointed a sub-committee made up of about a dozen of the most capable lessees and engineers to prepare the means of enabling the lawyers to draft a bill, and the requisite preliminary expenses have been subscribed.

COMPRESSED AIR ENGINES.

AS USED FOR HAULING AND PUMPING UNDERGROUND AT THE THORNHILL COLLIERIES.

The discussion of a paper on the above subject, the joint production of Mr. W. P. Maddison, mining engineer, and Mr. Farrar, of Barnsley, was resumed at the meeting of the Midland Institute of Mining Engineers (of which Mr. Maddison is president) held at Wakefield. The paper was considered one of the most valuable and elaborate which has been read before the Institute, and as we gave a *resumé* of it at the time from its importance to the mining community, we propose to give the opinions relating to the subject of some of the leading engineers, as well as some further experiments made by Messrs. Maddison and Farrar at the previous discussion. Mr. Hopton, of Barnsley, said that it was *prima facie* evident that air, which, when just compressed, had perhaps a temperature of about 100°, and after flowing a certain distance was then found reduced by 50°, must have suffered some loss of elasticity, were the temperature of the air in the compressing cylinder made sensible by the compression—conserved by any means till its arrival at the air-engine—it would then disappear in the cylinder as heat and be transformed into work, the original temperature being restored without loss of heat or energy. As to whether the heat engendered did not in a great measure indicate the accumulated pent-up power, might be answered in the affirmative, and most accurately so, provided that the engendered heat was also pent-up. When that heat was allowed to escape it showed that there was a want of power at the air engine, or an increased expenditure of work in the first instance. The experiments made proved that heat was another form of energy, consequently, as the engine was having power put through it, there was no alternative but for its entire reproduction as heat when no mechanical work was being done. Heat, therefore, must be evolved during the continuance of the work which was producing it, and the temperature, as a natural result, would rise, until eventually it was diffused and absorbed by surrounding substances as fast as it was produced. Motion of masses must communicate either mass motion or atomic oscillation in the interior of masses; whilst, on the other hand, if atomic oscillation was lost during storage or transit, it could not be transformed into motion of masses according to the first law of thermodynamics. If heat was lost by absorption atomic oscillation would also be lost, and the result would ultimately be loss of mass motion, with a corresponding non-utilisation of the original power. Therefore, if that loss of heat corresponded in value to what a neighbouring substance had gained, the correlated loss of power would = $W \times S \times 772$ foot-pounds, where W = the weight of the substance T = its gain of temperature presumed to be equal to the loss by compression, and S = specific heat of the substance in question.

Mr. Warburton remarked that the authors stated they had a very strong opinion on the question of the loss of power by the development of heat, as deduced by Mr. Warburton in his paper, and it was determined that a set of experiments should be made, with a view of eliciting data on which to form a more decided opinion. An experiment of 30 minutes duration, with air blowing off at 15 lbs., steam at 40 lbs., resulted in raising the temperature of the cylinder, compressing the air 63° Fahr., and the air in the receiver 10° Fahr. In the second experiment the air was blowing off at 30 lbs. pressure; outer temperature, 40°; cylinder and pipes, 47°; steam pressure, 40 lbs. How long it would take to get the air up to 30 lbs. was not stated, but from the commencement of blowing off in five minutes the temperature had been raised on the cylinder 61°, and in the receiver 12° Fahr. At the termination of 30 minutes, after blowing off the cylinder, temperature had risen 111°, and the air in the receiver 24°. In the third experiment, the air blowing off at 45 lbs., the temperature in the cylinder was 50°. Up to blowing off the cylinder air had risen 103°, or up to 153°, the temperature in the receiver blowing off 68°. At the end of 30 minutes the cylinder temperature had risen 49° more, or a total of 152°, whilst the heat in the receiver had, taking it at 50°, risen 39°, and at the time No. 1 receiver registered 79°, No. 2 registered 47°, No. 3 receiver registered 44°, and No. 3 exhaust 19°. The No. 3 experiment was continued, air blowing off at 58 lbs. The first registration at that pressure was in four minutes after the last at 45 lbs. pressure. During the four minutes the pressure had gone up to 58 lbs., but the temperature in the cylinder had gone to 218° or 16°, and that in the receiver to 89° or 10°. The experiment blowing off at 58 lbs. was continued 74 minutes, with an increased temperature in the cylinder of 75°, and in the receiver at 23°. What he wanted to show when heat was given off was the amount of loss. He held there was a loss. The authors of the paper say, "Follow the last experiment through, and it would be found whilst the heat generated at the cylinder stood at 250°, the heat registered at the receiver, close alongside the engine, only reached 97°, and the same density, or elastic force, existed in the pit at No. 2 engine at a temperature of 44°." Now, it was the thermal difference which constituted the loss, and the figures proved it. The speaker, by figures and quotations, contended that when they lost heat they lost power, and asked if they did not do so how did it happen that with a small loss of power by passage through the valve the heat dropped in the receiver 50°. If that was not loss of heat or power he did not know where to find it. Mr. Daniel did not think the question of loss of power by heat developed during compression required any figures to prove it. If they could develop 250° to 260° without any loss of power, why not develop 1000° or 2000°? If they could develop heat without power they had discovered perpetual motion. Other speakers followed at

great length, and at the subsequent meeting Messrs. Maddison and Farrar introduced the results of another experiment with the engines:

Time.	No. 1 engine.				No. 2 engine.				No. 3 engine.				No. 4 engine.			
	Steam pressure in boiler.	Air pressure.	Strokes made each half minute.	Average number of strokes.	Standing.	Running.	Standing.	Running.	Standing.	Running.	Standing.	Running.	Standing.	Running.	Standing.	Running.
P.M. 12-45	40	50	—	—	60	—	—	—	—	—	—	—	—	—	—	—
46	—	57	—	—	—	—	—	—	—	—	—	—	—	—	—	—
47	—	52	25	30	—	—	—	—	—	—	—	—	—	—	—	—
48	—	48	23	28	—	—	—	—	—	—	—	—	—	—	—	—
49	—	44	26	30	—	—	—	—	—	—	—	—	—	—	—	—
50	—	42	26	30	—	—	—	—	—	—	—	—	—	—	—	—
51	—	40	26	30	—	—	—	—	—	—	—	—	—	—	—	—

The experiment was made with all engines running simultaneously, with a full load. All were started at 12-45, and a person was stationed at each engine.

No. 2 engine ran the set in 2' 40", taking 316 strokes—119 per minute.

No. 3 " " " " " " " " 375 strokes—83½ " "

No. 4 " " " " " " " " 365 strokes—60 " "

No. 1 engine average speed, 232½—46 strokes per minute.

The No. 1 engine was running at 12-45 very slowly, just sufficiently quick to keep up the surface pressure, because under no circumstances could all three engines (Nos. 2, 3, and 4) be required to start away with a full load, except there had been nothing done in the pit for a length of time. The figures recorded at 12-47 show beyond a doubt that when all the engines were running with full loads, and the largest consumption of compressed air was going on, the 4½-in. pipes from the surface to No. 2 engines were too small for their combined requirements, seeing that there was a difference of not less than 8 lbs. pressure between No. 1 and No. 2. The record at 12-48 showed how almost instantly the pressure rose at No. 2, whilst at the same time there was actually a depressing influence going on at Nos. 3 and 4, proving as clearly as in the former case that the 3-in. pipes were too small for the work when Nos. 3 and 4 were hauling their sets simultaneously. Such the experiment so plainly demonstrated, that Mr. Maddison determined to replace the 3-in. pipes lying between Nos. 2 and 3 with pipes of larger dimensions. In concluding their very interesting supplementary paper, Messrs. Maddison and Farrar state that the great question raised by their paper was whether or not compressed air was a medium for transmitting power underground, such as might be made use of by managers of collieries with safety, economy, and efficiency. In the remarks in their first paper, under the head of "Cost of Haulage," it was stated that coals could be hauled in 6-cwt. tubs, and in a seam of coal in no case exceeding 3 feet in thickness, along one and the same road, to the extent of 100,000 tons annually, at a cost of 2-237d. per ton per mile, and consider it would be admitted that they had proved its efficiency and economy; whilst, as regarded safety, the fact was so apparent that it would be absurd to discuss it. That the subject was yet in its infancy, and was doubtless open to many and great improvements, they freely admitted. Gas jets, it was stated, applied under the exhaust of each cylinder, prevented the formation of ice. The matter was further discussed at the meeting at Wakefield, and was again adjourned to the gathering in the month of November.

ANCIENT MINING—THE GRECIAN MINES RE-OPENED.

THE MINES OF LAURIUM.

Erichthonius was King of Athens 1400 years and more before Christ, at the time when the great Sesostrius commanded the armies of Egypt in Syria, Mesopotamia, Armenia, and Asia Minor, and Moses led the Hebrews into the Wilderness of Sin. Then were first discovered the silver-lead veins running between the mica schist and limestone formations of the promontory of Laurium, stretching from Cape Sunium to Athens. So Pliny says. From its mountain tops, 1000 feet high, the spectator beholds the peaks of Euboea, the Isles of the Cyclades, the bay of Salamis, and the shores of Argolis, as far as the heights of Lacedæmonia, Corinth, and the steep of Arcadia, all that theatre in which was played the immortal drama of six centuries, from the departure of Xerxes to the arrival of the Goths.

Under the government of Themistocles each of the 20,000 free citizens of Athens received 10 silver drachmas annually as a State tax of 4 per cent. on the total product of the mines, which, therefore, must have amounted to 4,000,000 drachmas, or 175,000*l*. The residue of the Athenians, 280,000 in number, were slaves, and got nothing. The mines were worked by slaves. Thirty years later, Pericles built with the silver of Laurium the Parthenon and other splendid monuments of Athens, and made abundant preparations for the long and costly Peloponnesian war. The State leased mining rights which were perpetual, alienable, and transmissible by will, for sums varying from one to two talents (220*l*. to 440*l*.), and the operators hired slaves even from Macedonia and Thrace. There was a "metal court" and "metallic laws" to settle contested boundaries, underground riots and contests, the robbing of pillars, and the improper driving of adits and galleries to the injury of neighbouring rights.

The war broke out. Laurium became a marked point of strategy. The coast was ravaged, the mines stopped up. Then the invading allies were driven off and the mines re-opened, and the Athenian mint resumed its wonted activity. But the Syracusan expedition failed, and Attica received a death wound. Finally the traitor Alcibiades induced the Spartans to make thorough work with Laurium. The mining regions were again invaded, conquered, desolated; 20,000 slaves revolted and fled. Athens fell.

After the return of Thrasybulus, some attempts were made to re-organise the mines, but their prosperity never returned. Their skilled labour was scattered; the mining and metallurgical traditions were lost; the sources of capital were dried up. Xenophon indeed wrote a work on "Revenue," devoting a whole chapter of it to the mines of Laurium, proposing the opening of new veins, a co-operative enterprise by the ten tribes of Athens, and the fortification of the mining districts in view of future wars. And his counsels were listened to. For awhile wealth again flowed into the city. But in the first century of the Christian era a grand revolt of the slave miners, who were most inhumanly treated by the operators, quenched the entire industry in a sea of fire and blood, never again to be revived until eighteen centuries had elapsed.

In Strabo's time, 10 to 15 B. C., the veins of metal were accounted to be exhausted; and all that was attempted was to smelt the debris or refuse heaps of former times. No doubt this meant only that the workings had reached what was to the Greek engineers an unprofitable depth. There is no good reason for supposing that with steam-hoisting machines and pumps, gunpowder and ventilating fans, these argentiferous lead veins would not be more productive now than ever they were in the palmy days of Pericles. Six slaves accomplished no more work than one of our free miners with the aid of powder and steam. Their only tools were an iron pick with a flat head, and a little chisel, made of round iron drawn to a point. Yet with only these they sunk and drove several thousand shafts and galleries, and excavated piecemeal enormous chambers in the marble and tough mica schist. The most ancient works communicate with the surface by long inclined gangways; but subsequently the mining grounds were reached by vertical pits sometimes 350 feet deep, always square (usually 5 feet by 6 feet), with smooth sides, and furnished with offsets for ladders at regular distances. In this vast labyrinth of abandoned works the marks of the tool are as fresh as if made yesterday, and the tools themselves, dropped at the signal for revolt, are found lying on the heaps of fall. The galleries along which the files of hod carriers took up their wretched march to and fro, are methodically marked by little piles of stones, long since cemented together by stalactite concretion. Ancient lamps are found in niches, black with ancient smoke. And near the bottoms of the pits rude sketches, made in the wall with a pick, mark temporary

resting places of those who climbed the ladders or posts of underground foremen who regulated their order of ascent. But not a lamp now shines, not a pick is heard, not a ghost of all that crowd of half naked and half desperate workmen remains to tell the tale.

When the mineral reached the surface it was sledged to pieces and picked. The leaner ores were pounded fine in mortars of iron or hard stone, and washed to increase its fineness. The washing troughs are very numerous; many of them are covered over with cinders of a subsequent age when the tailings were exploited instead of the mines. They are quadrangular basins, lined with cement, connected by channels, the whole forming squares of 35 or 40 feet on a side. In the midst is a horizontal area slightly inclined. The gudgeon holes of a jiggling machine are to be seen in the sides of one of these basins, the others serving only to receive the washed ore of greatest density and richness. Water was evidently precious, for it was collected in great cylindrical or quadrangular cisterns, excavated in the rocks and cemented, holding from 3500 to 16,000 cubic feet. Rock-cut stairways served the workmen for cleaning out the pools.

Enormous mounds of tailings exist around the mountains, holding 6 to 7 per cent. of lead, and from 3½ to 4 ozs. of silver to the ton. The foundries were ordinarily placed near the mines, but some were on the sea-shore, at Thorico, Cypriano, Ergasteria, Pacha, and Lagrana. Others were distributed among the villages of the interior, now called Megala-pephka, Berzeko, Sinterini, &c. Some of the furnaces have been disinterred from beneath mounds of scoria. They were low cylindrical hollow stones of mica schist or trachyte, about 3 feet in diameter, heated with charcoal from the neighbouring forests, or brought from the mountains of Macedonia and Thrace, and blown with (goatskin) bellows worked by hand. High chimneys were built to carry off the noxious gases.

The products of fusion were: 1. A lead matt holding from 50 to 100 ozs. of silver to the ton; 2. Scoria; 3. Oxide of zinc, which condensed in the chimney or on the furnace walls in layers, and was sold to the physicians. The matt was then cupelled under a current of air, the lead oxidised to litharge, and the silver button left in the bottom of the crucible. Pliny calls the litharge "scum of lead." It was sold, partly revived, making an impure lead, and manufactured into clamps, tubes, vases, cramps for masonry, and white lead paint.

The centuries rolled on. Pirates by sea and bandits by land destroyed mines, manufactures, and commerce together. Normands, Sicilians, Catalans, Venetians, Genoese, and Turks by turns prevented all possible return to industry. Chateaubriand in 1806 found in all the Laurium peninsula but one poor hamlet of 800 souls. In 1863 the district was headquarters of bandits obedient to a little king called Kytzos.

One evening in May, 1863, two gentlemen, one French the other Italian, owners of mines in Spain and Sardinia, and heavy merchants of Marseilles, landed from a coasting boat on the long-deserted beach of ancient Ergasteria, at the head of a lovely mountain-locked harbour, having Helena's Isle as a breakwater in front of it. With the practised eye of men accustomed to the search of metalliferous deposits, they perceived the value of the mounds of debris which the old miners had rejected, and then and there, without further delay, they entered into negotiations with the Parèdre and Chinitòs, or village headman and his council. They found that some of the property was in dispute between the village and the Government. However, they completed the purchase with the village, determining to make it right with the Government afterwards. A treaty of purchase was formally made, and the whole village turned out to celebrate the event in rejoicings and festivities. The explorers returned to Athens highly delighted with their prospects. Count Amelot, at Athens, arranged that the Government rights should not stand in their way. They deposited 400*l*., the full value of Government claims, with the Treasurer of State. M. Fiedler, sent by the Greek Government in 1837, and M. Riessegger in 1842, had pronounced the Laurium district worthless. But the new comers had discovered refuse heaps concealed beneath the soil, where no one dreamed of anything valuable being concealed. They received a concession, or mining right, covering 2500 acres, or six square miles, comprising about the 1-20th part of the metalliferous surface of Laurium. The concession included the right of exploring the ancient mines, and the right to the silver lead ores in their neighbourhood.

In less than two years they created one of the grandest lead foundries in the world. The traveller can take the company's steamer "Laurion" at the Pireus of Athens, and find in the harbour of Ergasteria a fleet of Greek, French, and English vessels; 1000-ton colliers from Newcastle; here a steamer from Marseilles unloading machinery, tools, wagons, rails; there the Greek blockade runner of Cretan notoriety; all about, lateen sail craft from every port in the Archipelago laden with legumes, fruit, and fish; and some from Lagrana landing scoria. On shore, to the left, range three great sheds, under which blaze the furnaces, in front of which run serpent-like streams of black lava, or modern cinder, which a crowd of half-naked workmen pry up, break off, and convey two-thirds of a mile away, in wagons by a tramroad, round to a southern shore of the bay. From the fusion sheds runs what looks like an aqueduct on arches, the gallery for condensation of the fumes, ending in a chimney mounted on an isolated hill, 4700 feet distant. Between the sheds are the blowing-engines, constructed in Marseilles, and roaring night and day. To the right are the store houses, superintendent's office, free hospital for workmen, stables for 300 horses, and a populous village, dominated by a many-coloured Greek church, in which almost every figure and custom in Europe may be seen.

To bring the materials of manufacture from heaps scattered over a district having a radius of from 6 to 10 miles, about 45 miles of perfectly macadamised roads diverge from the port, cross the ravines by substantial bridges, and ascend the slopes. They are almost the only roads existing in good order in the kingdom of Greece; 300 horses draw down in wagons every day 400 tons of scoria to be washed, enriched, and smelted over again; and the works could handle more than they receive. It takes 5 tons of debris to give 1 ton of mineral proper for fusion. The colossal waterworks are capable of washing 500 tons a day. Finally, a railroad (of 3 feet 4 in. gauge, and 6 miles long) is undertaken to reach the most important of the debris mounds in the valleys of Camaresa and Berzeko, on the other side of a watershed, 450 feet high, through which it passes by tunnel. Eighteen months sufficed for its construction, and three powerful Mülhausen locomotives draw trains of 110 tons, over gradients of 26 to 1000 in 6-ton wagons built at Lyons. The rails were rolled at Besseges; the repair shop, machine, tools, got up by Bouhey, in Paris. But the two steam-engines for the washing grounds, of 90-horse power each, made in Belgium, were not transported to Greece because the wretched Government of this worthless little country took advantage of the German invasion of France to inaugurate a reactionary policy towards these foreign regenerators of home manufacture worthy of the worst days of the worst and most unhappy countries.

The sudden conversion of a desert into a source of such vast wealth excited the cupidity alike of the Greek Government and of the brigands to whom it grants protection. Kytzos demanded 2000*l*. as the price of leaving the company alone, but was fortunately killed before he could enforce his demand, and Spagnos, who succeeded Kytzos and Arranitikis, since of melancholy notoriety, also attempted on one occasion to seize the Director-General of the mines, and finally a pitched battle was on the point of being fought between a Greek company and the Franco-Italians, which was only averted by the arrival of troops from Athens. Public feeling at last got so worked up in Greece at the sight of a number of foreigners exporting their mineral wealth and pocketing the profits, that the Government was forced to pass a law declaring all scoria and debris of old mines Government property and giving the law a retrospective effect, on the strength of which they claimed not merely an exorbitant tax from the Laurium Company for the future, but a sum of 80,000*l*. for back payment for the eight years before the law was made. This the company naturally refused to pay, and the diplomatic agents of the two Governments found themselves compelled to interfere to protect their subjects from so extortionate a demand. The Greeks continued more obstinate, as they perceived the richness of the prize won by the foreigner, the value of which was estimated by their own official reports at a milliard of francs. The company in despair, after the events of the last two years have so completely crippled the power and influence of France, of being able to continue to work their property in security, offered at last to sell

for 500,000*l*. to the Greek Government what the latter valued at a milliard. An agreement to this effect was made with Komounodorous, then Prime Minister, and he promised to bring in a Bill authorising the sale. At the last moment, however, he perceived that no such Bill would be carried, and attempted to postpone it. The King would not permit this breach of faith, and Komounodorous, rather than face the inevitable defeat which it would entail, resigned. He was succeeded by Deligeorgis, who has written a memoir, resigning the law, and receding from the agreement of his predecessors. He has proposed, indeed, to abolish the law, and let the question be tried by the judges; but this is a manifest absurdity, as the dispute only arises out of law which would then not exist, so that the question itself would fall to the ground. Meantime, the French and Italian Governments are both beginning to lose patience. There is no doubt that under the Empire France would not have tolerated for a day the action of the various Greek Cabinets, whose ruin the Laurium question has successively involved in this matter; and there is a limit even to French patience just now, while the Italian Government is rising into a position of such European importance that it may not be loath to take advantage of the occasion which is thus afforded of asserting with a strong hand the justice of its claim.

All that remains to add to this already extended notice of the Laurium enterprise are the statistics of work done. Nothing is handled which contains less than from 8 to 12 per cent. of lead. When properly mixed, the materials are charged with coke into cylindrical fires 4 feet 8 in. high, blown with fans. The cinder which escapes below still holds from 2½ to 3 per cent. of lead; 2 per cent. more is carried off in fumes. The residue is drawn off twice a day in pigs marked "Ellas." This bar lead (very antimonious) contains only from 10½ to 14 ozs. of silver to the ton. A part of it is refined at the works and marked "Fos." Both brands are sent to England in exchange of coal. No cupellation is attempted at Ergasteria. Each fire passes 30 to 35 tons of scoria per day, and 12 of the 18 fires are in blast night and day. The annual product is 9000 to 10,000 tons of lead, which is almost equal to half of the entire make of France.

TIMBER MEASUREMENT.

SIR,—Not having seen yet any reply to the enquiry with which your correspondent, "Ironpen," concluded his letter in the Journal of Sept. 21, I venture, though not a timber merchant, to submit the following approximately correct rule for finding the cubic contents of a timber balk. Multiply the length in feet by the square of the mean girth in inches, and divide the product by 2304 in the case of a balk of square section, or by 1810 for a balk of circular section, the quotient in each case will be the contents of the balk in cubic feet. Taking the instance proposed by "Ironpen" of a balk 30 feet long, with a girth of 24 in. at one end, and 16 in. at the other, or a mean girth of 20 in., the contents by the above rule are 5-21 and 6-63 cubic feet respectively, according as the balk is of square or of circular section.

For a balk of these dimensions, and for all of similar proportions, the above approximate results are not more than about 1½ per cent. too low, the correct contents being 5-28 and 6-72 cubic feet respectively. For, putting L for the length in feet, G and g for the end girths in inches, and M for the mean girth in inches, the correct contents in cubic feet are the product $L \times (M^2 - \frac{1}{4} G \times g)$, divided by 1728 for a square balk, or by 1357 for a balk of circular section. BALK.

Oct. 9.

STAMPS AND STEAM-HAMMERS.

SIR,—There appears to be at present a considerable amount of competition going on between stamps and steam-hammers for pulverising metalliferous ores, and in the face of the so-called improvements such an eminently practical man as Capt. William Teague is erecting the old-fashioned Cornish stamps as the most efficient and economic. This naturally leads many of us to enquire what is the correct principle of stamping—the high-speed principle, or the low-speed principle? And the best way of arriving at this is to enquire how much can be got through in the course of a day. I believe that from 1 ton to 1½ ton of ore per day is considered very good work for each head of the old Cornish stamps, and the new spring-stamps are said to do the work of 10 or 12 Cornish stamps; we see, then, that each head will get through at least 13 tons of ore per day, and as 40 heads are to be erected at Terras Mine they will be enabled to stamp 520 tons per day, or in the year of 300 working days about 156,000 tons of ore might be stamped in the course of twelve months. Now, the Terras tinstone never contains less than 56 lbs. of tin to the ton, I suppose; so that this would represent 75,000 cwt., or 3750 tons, of tin as the anticipated yield of the mine. It is upon these grounds that I have no hesitation to give the preference to the spring-stamps, for I feel convinced there is no mine in Cornwall returning upwards of 300 tons of tin per month with only 40 heads of stamps.

It has been objected that the first cost of the spring stamps is greater than that of the ordinary stamps, but even Capt. Teague may be mistaken in paying too much attention to first cost if 500 tons of tin per month can be returned with 48 heads only, especially if the stamp-power per head and the wear and tear be not materially increased. Of course, the wear of the stamps' heads would always be nearly in proportion to the number of tons of ore stamped, although even in this the nature of the blow might cause some difference in favour of the spring stamps. The great question, however, is the price per ton at which the ore can be stamped, and this has not hitherto been very prominently noticed. With the ordinary Cornish stamps it is usually estimated at 1s. 3d. to 1s. 6d. per ton of ore, and we want similar particulars as to the spring stamps.—Oct. 9. AGENT.

AUSTRALIAN TIN.

SIR,—We have seen some wonderful reports published in your valuable Journal occasionally respecting the tin discovered in Australia of late. It is now some months since we first received intelligence of these reported extraordinary discoveries, and many people, no doubt, expected that by this time we should have been completely inundated with tin from the southern hemisphere, but what really does it all amount to? Very little tin has found its way to this country as yet, nor is it likely to for some time to come, even if it does at all, which seems highly improbable. Such reports as we have read always sound well from a distance off, and cause some excitement for the time, but we must take them *cum grano salis*, and if we take them with a very large grain in this instance I think we shall be on the safe side. Of course, it is to the interest of the colonials to puff up their vaunted discoveries as much as possible, in order to get some of our British capital out there; but that there will be a grand burst up in most of these new tin companies recently started there no one with any reflection can for a moment doubt. The promoters and brokers will, of course, reap their reward. The Yankees have tried this dodge on before to-day, and there are many very clever youths from the Eastern shore out in Australia always ready to take in the unwary.

ANTIPODES.

WHAT TO SELECT—WHAT TO AVOID—No. XXX.

SIR,—October is the most favourable month for investors; values, in almost every instance, are reduced to the lowest minimum; sound securities can be procured at prices far below their intrinsic value, from which a rebound will ensue as soon as the busy season sets in.

Mining quotations, from various causes, are just now unduly depressed, but this is only temporary in character; a sharp reaction will shortly commence, culminating, in all probability, in a period of inflation, during which prices may rule as much above the real value of the respective properties they represent as they are now as far below their commercial worth.

WEST TANKERVILLE.—It will be recollected that about this time last year the writer drew attention to this mine, pointing out that it adjoined the Roman Gravels, similar in geological formation, and traversed by some of the principal Roman Gravels mineral veins. The writer also pointed out that the company possessed ample capital to efficiently and thoroughly develop the mine, and that he had the greatest confidence in success being eventually realised, adding that a discovery may be made at any moment which would

cause an important advance in the price of the shares. It may not be without interest just now to state that West Tankerville has the same management as Tankerville and Roman Gravel. It is a well-known fact that the returns from West Tankerville supplied the local company known as the "Lawrence" with nearly 500,000. For continuing their mining operations throughout this district. West Tankerville, at that time known as Old Bathoole, yielded from one vein alone (Wood vein), the chief one worked upon at that time, ore to the value of about 300,000, the exploration having been extended to a depth of only 18 fathoms from surface. It may be mentioned that pig-lead at this time was selling at about 87 per ton, its present price being 217. Through mismanagement and misrule generally, the Laurences came to grief and abandoned all their mines. Since then, however, the Snailbeach Mine has been resumed, has yielded and is now yielding enormous returns, the present monthly output being equal to 250 tons. Tankerville (then called the Oven Pipe), and also Roman Gravel, have proved themselves established dividend properties. Upon the authority of Capt. Arthur Waters, the manager (who is also the manager of Roman Gravel and Tankerville), the Roman vein, so productive in Roman Gravel, runs parallel to the West Tankerville boundary, and will be altogether into the sett at 200 fms. below adit, when West Tankerville will contain all the productive lodes of both mines. Besides the thirteen lodes known to be within the West Tankerville boundary, the Snailbeach great lode comes into and traverses the sett for about half a mile. The writer, in his notice of this mine last autumn, stated that there is no geological or mineralogical reason why, upon adequate development, West Tankerville should not be in every essential equal with Tankerville and Roman Gravel; indeed, this is plainly indicated by the fact so strongly dwelt upon by Capt. Waters, that all the great deposits of lead in this locality are found where the rocks are much contorted by the apparent influence of the Greenstone, and nowhere in Shropshire does this rock come up in greater force than in West Tankerville.

Finner's Hall, Old Broad-street.

OBSERVATIONS ON MINING IN WALES—No. I.

Sir,—In the Supplement to your valuable Journal of Sept. 14 your correspondent, "A Tourist," calls attention to some of the lead mines of Cardiganshire. Will you kindly insert this from me, another tourist, who in June last took a pedestrian stroll of three weeks through North Wales? It would be impossible for me to state all I saw and heard that is worth communicating in this letter, therefore I shall crave your indulgence to insert one or two more letters at a future time.

Having spent a few days at Beddgelert, and also at Bettws-y-Coed, I visited the old celebrated, and worked from time immemorial, copper mines of Drws-y-Coed. The copper here is of a very rich quality, and not worked by any means on the scale which so rich a mine ought to be. This mine has been worked and re-worked at different periods since the time of the Romans, and yet, although the veins appear to be very rich, with a good percentage of copper, and many hundreds of thousands of pounds worth of copper sold, the mine may be fairly stated to be only in its infancy, if only fairly opened up and developed.

I feel a great interest in copper and lead mines, and I believe I ever shall do so, in whatever country they may be, for whatever I have either acquired or inherited has been drawn from those sources of industry at different times.

I visited, also in the same district, the Cwm Dywfor copper mine, a comparatively new mine, though it is evident the Romans or the Britons have been at work here. I am inclined to think that we often give credit to the Romans at the expense of the Britons with regard to many of these old workings. Here I saw some fine piles of copper taken out of a mine that is evidently getting opened up in an energetic and praiseworthy manner, under the intelligent and able management of Capt. Collier.

While in the district I also visited the Llanberis Slate Quarries. They are the property of Mr. Ashted Duff Smith, and are worked upon a very large scale, employing some thousands of hands. The slate here is of the very best quality, and the yearly produce is immense. This district is one of the finest in North Wales for its beautiful scenery and views, and well repays the artist for his labour, many of whom I was told visit this district yearly. The pass at Pant Aberglaslyn almost surpasses anything I ever saw for beauty and warmth of colour.

Bettws-y-Coed is also a charming spot, with its beautiful scenery, its y-hydri (or rather Rhadr-y-wydd), perhaps the finest in North Wales. This is also a very great place for trout angling, and many are the devotees of old Isaac Walton who can be daily seen along the banks of its streams and lakes. The views about the neighbourhood are also very beautiful, and produce abundant study for the artist, while the geologist will find a good field for his researches. The general stratification is the Cambrian clay-slate, and I was shown several mineral veins unworked in the neighbourhood. Our guide, an old miner, had brought his pick with him up the valley, and took out of two fine looking lodes several stones containing fine spots of silver lead. He also assured us that if these lodes were properly worked, they would be found to contain nothing but a mass of mineral riches. Be this as it may, and without committing ourselves strictly to the opinions of our friends, we thought—looking at the strong gossip on the back of these lodes, as well as other characteristics at surface—that they well deserved attention from adventurers. Neither is Bettws-y-Coed without some interesting historical traditions, many of them very interesting, which, of course, I cannot enter into at present. There is a large ancient mansion here, standing on a beautiful site called Gwydyr Park, the property of Lord Willoughby de Eresby, built from designs by Inigo Jones, by the eminent Sir John Wynn, of Gwydyr, a Wynn of the same ilk as the Wynn of Wynn. We had no time to visit the Gwydyr Park or Willoughby Lead Mines, in the neighbourhood.

From here we went and visited the celebrated Penrhyn Slate Quarry, the property of Lord Penrhyn. This is the largest slate quarry in the world, employing a vast number of workmen. It is certainly one of the greatest wonders of the present age. The noble and spirited proprietor is considered a very humane, kind man, and greatly respected by all the workmen at the quarries, and, in fact, by all classes of the community in the Principality.

From here we proceeded to Port Madoc, and thence to Ffestiniog. The slate quarries at Ffestiniog are of a grand scale. The principal proprietors are Mr. Holland, M.P., Mr. Percival, Mr. Graves, and the Welsh Slate Company. The quality of the slate at each of the above gentlemen's quarries is good, and much of the same character at each quarry.

From here we proceeded to Dolgellau. The gold mines of this neighbourhood, a few years ago, created almost as much noise and excitement as the Californian discoveries did a few years previous to that. It is not the excitement of simpletons that will bring out rich gold mines, nor any other mines. The gold excitement at Dolgellau has quite abated, and it has settled down to its proper level. How well would it have been for the most part, that more attention had been paid to the well-timed advice of Mr. Parry, an old and experienced miner in those mines, and gone on in a sure and steady manner to open up their mines, and by such means bring them into a profitable state, instead of throwing their money away by thousands for German and other machines—theoretical and complicated things, that were not calculated to be of any service beyond putting money into the pockets of the inventors, or rather adventurers. The consequence of such ridiculous waste has been the ruin of many of the companies, and the bringing of the mines into disrepute, and not by any means the poverty of the veins themselves.

From here we proceeded to the neat and quiet, though ancient, little town of Machynlleth, situated on the Dovey river, and almost surrounded by some of the Montgomeryshire and Merionethshire hills. It was here that the celebrated rebel chief, Owen Glyndwr, held his Parliament. The Earl Vane has a residential mansion close to the town, and is a large landed proprietor, much respected in the neighbourhood. The Corris and Aberllevny slate quarries do a large business.

From Machynlleth we proceeded by road to the Dyffryn Mine, a distance of ten miles. This mine has been worked at different times for the last 200 years, and is said to have been worked so far back as the time when the Romans were ransacking the various mineral lodes in various parts of Britain. The mine was taken up and resuscitated several years ago by the late Mr. Hugh Williams, the father of Mrs. Cobden, and by him and his brother-in-law, Mr. Pugh, was worked for a great number of years at a large profit. After the death of Mr. Williams the mine became the joint property of his children, who sold it to the present company, Mr. John Bright, M.P., being at the head of them. The present company have for several years been returning lead ore at the rate of 250 tons per month, worth upon an average 137 per ton, and has been producing very large profits; but they are not doing so well at present, though I was assured by several parties about the mine that the prospects are equally as good as ever, if the company would only open up new ground, for which I was given to understand there is ample room. There is powerful and ample machinery on the mine for pumping, dressing, and panning the ores, and all in first-class condition.

From here I proceeded south, over the mountains, in the direction of the Severn river, with the object of winding my way along the banks of that stream to Llanidloes, visiting the most notable mines as I went. In crossing over the hill, and about a couple of miles south of the Dyffryn Mine, I fell in with Capt. Price, who was coasting on the back of what appeared to be a very beautiful lead lode, upon the side of the hill, about 400 or 500 yards south from the river side. Mr. Price pointed out two other lodes to me, all converging nearly to the same point. This is a new grant of a very large tract of mineral ground, upon which there has never been any trials made before. Mr. Price's assistant broke several stones out of one of the lodes while I was present, containing nice small spots of lead and copper. I accompanied them to the western side of the sett, and there I saw a very strong and beautiful looking lode, showing small spots of copper where it had just been opened upon. There appears to be ample water-power here on each side of the mountain for all mining purposes, and also great facilities for driving levels on the course of the slippery lodes into the hill from each side. I should think that, with ample capital and spirited development, this sett would eventually prove one of the best things in this part of the country, and I congratulate the owners upon their possession of so large and beautiful a mining grant as the Cefn Hafod and South Dyffryn. What is required is that they enter into its bowels, and bring out its hidden treasures, which have been lying dormant for so many thousands of years, or otherwise they may as well, and better, be without the grant.

From here Capt. Price accompanied me on his way homeward, and very kindly showed me over the Nant-y-Ricket Copper Mine, of which he is part owner. Here I was quite astonished at what I saw. The splendid rich piles of copper, of all hues of colour, was quite surprising. It never occurred to me before that Wales, apart from the Cefn Mountain, produced such very rich copper. It put me in mind of some of the rich piles of copper I had seen some years ago in the western parts of Cornwall. There are several copper lodes here running parallel into the mountain in a westerly direction, several fathoms wide. I say in an adit level on the course of one of these a branch of solid copper ore, full 18 in. wide. Some parts

of this branch were of a yellow colour, other parts a nice pink, others black, and some red; and in another level I saw a branch, about 8 in. wide, of a black-blue colour, quite pure. Some of the copper ores here, Mr. Price informed me, yield as high as 34 per cent., and will average all through 20 per cent., when properly prepared for the market. Capt. Price, who is evidently a skilful miner, and a very intelligent man, pointed out to me the direction of several very lead lodes, and I saw in some rocks of carbonate of lime (which is very strong here), brought from the present end of one of the copper lodes a beautiful mixture of silver lead; as I was getting late in the evening, and I had six miles to walk before I should reach Llanidloes, I had no time to examine the lead lodes, but understood that one of them was the Great Van lode. It is a misfortune and a pity that so rich and valuable a property did not fall into better hands than it appears to have done, for a more miserable attempt at mining than at Nant-y-Ricket has never come under my notice, nor, I am quite sure, can there be found in all the known world. It is simply digging out copper from the backs and different places wherever the lodes are and have been exposed by denudation; without regard to any system or method whatever. Half-a-dozen paupers could work it equally as well and methodically as the present company do.

What is most surprising is that Sir W. W. Wynne and his agents should allow so very valuable a property to be so miserably trifled with. I understood at Llanidloes, the same evening, from some gentlemen I met with there, that those parties have actually had Nant-y-Ricket for the last five years; that it was put into their hands (some one or two Liverpool men) in 1867 by the Mr. Price already referred to, who had had a grant of the sett some years previously, and by his industry and skill had managed to discover those rich copper lodes, as well as several lead lodes; but not having capital to work it himself agreed with those gentlemen to let them have three-fourths of the mine for developing the same, his holding his fourth part free. It was further stated that, besides in not opening up and developing the mine, those parties had behaved very badly to him in many other ways. From all that I could learn (I am afraid unless the owners of the minerals should come to his rescue, poor man!) he will only receive from Nant-y-Ricket what is too often the reward of the honest and industrious man, neglect, and ill-usage.

The next place I visited was this district—the Great Van Lead Mine, and it is certainly quite a wonder in its way; but as this letter has run to a considerable length, and as I visited several other places in this district, I shall leave what other remarks I have got to make for another letter. ANOTHER TOURIST.

Dolston Rise, Sept. 27.

HELSTON WITHOUT A RAILWAY.

Sir,—It was thought a few years ago, when an Act of Parliament was obtained for the construction of a line from Penryn to Helston, that an obvious want would have been supplied. Instead, however, of executing the work the promoters abandoned the scheme, under an Act which gave them that power. The proposed line went, via Constantine church town and Gweek, to the south end of Helston town. Many persons spoke contemptuously of the line, designating it a "potatoe line," but without justification. I think that the first railway connection with Helston should be from the Gweek road station, because a line to that point would enable passengers to go to Penzance and Truro, &c., and would open a communication with Hayle—which is an important port and foundry—and with the populous district of the Tamar, and the Looe, &c. It should be carried to the West Cornwall Mines by a branch up the Lowertown Valley to Coverack Bridge and above. Such a line as this would certainly pay. Great Wheal Vor, Great Work, and many other mines would be supplied through it. The course would be by Carnell, Clowance Wall (western corner), through Wheal Abraham, near Crown town, and near Siltney village to a station near Helston church. Both goods and passengers should be carried on it. The intermediate stations should be at the following places—Clowance Corner (for Crown, Leedstown, &c.); and near Crown town for Wheal Vor and the numerous places around. Gentlemen willing to undertake the work would do well to ask the co-operation of the respectable solicitors at Helston, who are largely interested in the lands and mines to be served by such a line.—Truro, Oct. 2.

RAILWAY TO ST. JUST.

Sir,—When I was at St. Just last week a London gentleman connected with a mine in that parish told me that it was intended to convene a meeting of the influential land and mine owners of the neighbourhood, to take into consideration the subject of a railway to connect the West Cornwall line with the mines in that parish. The necessity for such a connection has long been felt, and the late Mr. Darke, about 17 years ago, had the line surveyed, and plans and sections prepared for going to Parliament; but the proceedings did not reach the House of Commons, for want, I suppose, of the necessary support. Since then a turnpike road has been formed, but the expense of the transit of coals, &c., over it is 5s. per ton—a heavy item in mining expenditure. I believe that a railway would pay its proprietors. It could be very inexpensively constructed, the ground being very favourable for the line. The course would be from the present terminus of the West Cornwall Railway to Trevelick Smelting House, and along that valley, via St. Ives, &c., to Penzance, which should for the present be its terminus, where, of course, there should be a station. Another station should be at St. Just village, and another at Smeared. It would be a mineral, goods, and passenger line. Passenger traffic between St. Just and Penzance is considerable, and so is that of goods.

The mines are numerous and lasting. I will name the principal—St. Just Amalgamator, Boscan, Boscan and Wheal Castle, Wheal Owles, Botallack, Carnarvon United, Levant, North Levant, Spearhead, Sparrow Moor, Boscanwell Downs, and East Boscanwell (late Wheal Hearle). All these mines and the passenger and other traffic are sufficiently to maintain a railway, and pay good interest on the capital required for its construction. I hope that the results of the meeting will be that measures will be taken for giving it existence.

Truro, Oct. 2.

R. SYMONS.

THE WINDING-UP OF THE GREAT SOUTH TOLGUS.

Sir,—At a special general meeting of the above company, held on April 11, 1871, three shareholders were appointed to wind-up the affairs of the mine, and "they were empowered to take all needful measures, and to do all needful acts, for the purpose of carrying the winding-up resolution into effect." One of the shareholders, however, thus appointed withdrew in disgust, in consequence of the sale by one of his colleagues in hot haste on his own responsibility of certain "tin slimes" for the miserable sum of 20s., the sum of 150s. having been subsequently offered. Without, however, entering into further details of the shortcomings of the two acting liquidators, I may say that they first sent an account of receipts and expenditure, which showed an available balance of 6117. 17s. 6d.; out of this 525s. 7s. has been divided among the adventurers, leaving a balance of 112s. 4s. 11d.; and as the only liability shown against it in the balance-sheet is a royalty on tin ores of 47. 16s. 3d., there seems no good reason why the cash balance, whatever it may be, should remain longer with the liquidators, especially as they charged in November, 1871 (nearly a year ago), a sum of 167. 10s. 6d. "for advertising for claims to be sent in." There will, no doubt, be only a miserable pittance to divide, but it is better in the pockets of the adventurers than where it is, for if they lose sight of it the liquidatorial expenses will become like the bottomless fabric of vision, and leave not a wreck behind.—Field House, Oct. 9.

CHRISTOPHER RICHARDSON.

GREAT LAXEY MINING COMPANY.

Sir,—I feel deeply grieved at reading a statement in the Supplement to last week's Mining Journal, under the head of "Great Laxey Mining Company," which cannot fail, if not promptly contradicted, seriously to injure Capt. John Kitto. It may please the directors of Great Laxey to choose to consider what they are pleased to call the "difficulties" and "abuses" with which they have had to contend as something stupendous, but allow me to observe that I know of my own knowledge that Capt. John Kitto was placed in his hands, and I say it without fear of contradiction, that any honest man with ordinary intelligence can do the same with those similar "abuses" which have sprung up since Capt. Kitto left the mine. It is not my place to speak here of Capt. Kitto's mining abilities, but I have known him for many years, and believe him to be a thoroughly honest man, to which title he would have no claim had he, as the article states, been unsuccessful in remedying the "abuses." During his management of Great Laxey he gave the most entire satisfaction, both to employer and employed, and no greater proof of this can be given than that when he went over in August the miners were ready, and accepted every bargain at his valuation.

The real truth of the matter is, that the Chairman has been the dupe of a system of misrepresentation and falsehood, which has entirely blinded him to the true position of the company and its management, and that that energy and force of character which he possesses, and which, if properly directed, would have been of such material service to the shareholders, has in a wrong direction greatly impaired their interests.—London, Oct. 10.

THOS. THOMPSON, SEN.

GREAT LAXEY MINING COMPANY.

Sir,—In the Supplement to last week's Journal, in an article on Great Laxey, it is stated that "I was as unsuccessful as my predecessors in remedying the abuses which now seem so difficult to get rid of, and that during my management the evil still continued." I can only believe that you are totally unaware of what those abuses then consisted, or you would not have admitted into the Journal a statement which is neither more nor less than a gross libel, and one calculated to do me a serious amount of injury. During the two years I held the management of the mines not one of those abuses existed, and I think not the slightest difficulty at the commencement in wiping out every one of them, and I unhesitatingly say that during that time no man received less, that he had not fairly earned, and every man was paid what was fairly his due. No sooner, however, had I left the mine than things began to go on very much as they had done before, and every man was paid the thing of the previous management would naturally have supposed would be the case. It is all very well for the directors to plead ignorance in those matters, and if the shareholders chose to believe them it is no business of mine.

I left the mines because the directors refused to allow me one week in every three months to visit some mines I was interested in in England and Wales, and I am thankful to say I have never yet had to regret doing so. This, however, I can say, that no dividend had been paid for eight years previous to the time the management was placed in my hands, and that the first two years under my management were the most prosperous years the company has ever seen; so I am content to leave it to you and the public to decide as to whose management the success of the mines are due.—Llanidloes, Oct. 10.

JOHN KITTO.

THE WHITEHAVEN IRON MINES (LIMITED).

Sir,—In the Supplement to the Journal of Aug. 31 I put some questions to Mr. R. Symons, and that gentleman said on Sept. 7 he would answer them in a week hence. Having waited four weeks, and received no reply, I ask him again, and also to answer on paper—How long can the mines work with the present capital? Mr. Symons may add the few tons that may be sold from Eskdale. Prof. Ansted

inspected the mines early in February this year. I have his report now before me, and, with your permission, I ask him to answer the same questions.

ONE INTERESTED.

NEW LOVELL MINING COMPANY.

Sir,—Great surprise is expressed at the unfair conduct adopted in the election of the new pursuer. The Chairman was interested in the election of the pursuer, and also in the supply of materials to the mine, and the election of pursuer in a most satisfactory and partial manner—for instance, one proxy for 165 shares, which should have been for 100, was unfairly rejected on account of the small error between 165 and 100. The rejection of this proxy alone enabled the merchants to elect their nominee. As the majority of the shareholders were legally in favour of Mr. F. Field, jun., can it be supposed that we are going to allow this rough-shod injustice to thwart our expressed wishes? Let some few large holders at once take active steps, summon a special meeting, and elect their financial officer, and justice will be done.

A SHAREHOLDER.

THE CRIDDIS COPPER MINE, PADSTON.

Sir,—My attention having been called to a letter in the Supplement to the Journal of Sept. 21, signed "J. W. P.," and referring to Criddis, I think it necessary to explain that the late manager of Criddis referred to is not me, and that I had within half-a-mile of the mine during all the time I was manager and engineer of Criddis, from Sept. 1, 1864, to December, 1865, during which time I removed from the Goss Moor a 40-in. cylinder engine, and erected it at Criddis under my sole superintendence, and also a 20-in. double engine with crusher and drawing gear, for the greatest possible expedition. Unfortunately contracted rheumatism which obliges me to use a walking-stick. However, that does not hinder me climbing ladders, which suits me better than walking on a level road. In fact, I was much complimented by adventurers and others on all my erections, as can be seen by referring to the Mining Journal of, I believe, Feb. 11, 1865.

D. R. STICKLAND.

Burrow and Butson Mines, Oct. 7.

THE TERRAS DISTRICT.

TERRAS AND FORTESQUE MINES.

Sir,—The satisfactory meeting of the Terras Mining Company at Gramppont-road last week must surely be highly gratifying to all holders of shares in properly conducted mines of the locality. I, for one, was induced to visit the Terras Mine during the height of scandalous attempts to injure the property, and when I saw, self, and bought largely at moderate prices; I thought I foresaw what now results.

I have also visited the Fortesque Tin Mine, almost adjoining, and am fully convinced this will be the next dividend property in the district, and have acted accordingly. I beg to subscribe myself one well pleased with, and a larger holder in—TERRAS AND FORTESQUE.

RICHMOND CONSOLIDATED MINING COMPANY.

Sir,—In carefully reviewing the present condition of our company's affairs at the mine, I can come to no other conclusion than that we are drifting towards bankruptcy as fast as time and mismanagement will carry us. Let us look at it, and what do we find? Why, according to the manager's reports, we have now two 70-ton furnaces up, capable of smelting 140 tons of ore daily, or 840 tons weekly, of an average yield of \$50 per ton, or a gross product \$42,000 per week.

Then, in addition to this, in the Journal of Sept. 28, the official letter states that "our ore dump at the furnace and mine is filled to overflowing," which our manager, I may here remark, appears greatly elated at, but with which we, as Englishmen and shareholders, should feel very much satisfied at if the furnaces had been up and running during the past four months, and the proceeds of the same had found their way into our pockets in the shape of dividends, instead of, as is the case, the time of our "foreman" and a "large force of men" under him should be "engaged in building a large dump" (to use a local term dump-headed work this, certainly!) adjoining our present dump at the furnace. When finished our new dumping ground at the furnace will permit at accumulation (which I maintain, ought never to have accumulated with efficient management) of 4000 to 5000 tons more than is possible at present; and when raising ore is resumed at the mine it will be raised and hauled to the furnace as fast as possible, but to what purpose I fail to see, if our "best men" are laid aside by the go-ahead policy of our manager in keeping them constantly at the first 70-ton furnace during the three months it was running, till they were almost poisoned, and to the utter neglect of obtaining the necessary lining stone for the second 70-ton furnace which was being erected under his own supervision, although he knew perfectly well that the stones would be required for some months prior to the furnace being ready to receive them. But in concluding my remarks respecting our manager at the mines, how he manages matters, together with the means placed at his disposal (for, in addition to those things already enumerated, we must not forget, and he would not have us forget, that he has of charcoal on hand on Sept. 1, say, 215,000 bushels, enough to carry us through the winter), I would say I have no doubt but that he does his best, and his heart may be in his work; but we want, if possible (and I fail to see the impossibility of such), a man who can so regulate matters as not to be keeping the very things idle, or nearly so, which are mostly required to be at work, as is the case at the present moment with our furnaces. A dead lock can generally be avoided by simple looking a little ahead.

But now, Sir, I must show you the result of our having these means at our disposal; and what do we find? Why, instead of smelting 840 tons of ore weekly (as shown above), worth \$42,000, we are informed in the Journal of Sept. 28, page 920, that "this week's cable message announces that the furnace in five days smelted 176 tons of ore, producing \$9900," and the Journal for this week, page 941, states, "the product for the week is \$9700, from 206 tons of ore." There is an old saying that "comparisons are odious," and if that were true it is pre-eminently so in the case before us, for, according to the figures given above (and I challenge anyone to dispute their accuracy), with judicious management, we ought to have smelted during the fortnight 1680 tons of ore, worth \$84,000, instead of which we are informed the actual result for that period is 382 tons, producing \$19,600, a deficiency on the produce for the fortnight of 1298 tons, which, valued at \$50 per ton, amounts to \$64,900.

But at this point I can suppose you to say, "Yes, your calculations are correct, but where are the evidences of bankruptcy to which at the commencement you referred?" I will show you, if you will follow me in my calculations a step further. Now, turn with me to the Supplement of the Journal of Sept. 7, and you will find an official statement, which in effect says, "The value of ore smelted during 51 days—that is to say, from May 21 to July 11—was \$120,000. This shows the gross returns in value of the bullion produced, and the manager in his letter, dated Aug. 13, states that the estimated net profit for those 51 days is \$41,736, being at the rate of \$855 (?) per day from one furnace only."

Now then, Sir, I presume you can see the bankruptcy in it, for surely if from May 21 to July 11, being 51 days, or say seven weeks, the gross product was \$120,000, then the net profit for that period amounted to only a little over \$40,000, thus deducting for expenses two-thirds of the product, or, in other words, \$80,000, which for seven weeks would be nearly \$12,000 weekly, why, of course, if during the past fortnight our product has amounted to only \$19,600, of necessity follows that we are going to the bad to the tune of \$2000 weekly, for our expenses, I take it, would be going on to very nearly the same extent. Now, Sir, I invite anyone to criticise my assertions and calculations, for if I am not right I am always open to be corrected, and I here state once for all that I have never put pen to paper in this matter for the purpose of discomfiting anyone or creating a mere money-making, but from the full persuasion that there must be an enormous waste somewhere, when I find a 70-ton furnace kept in full blast for 51 days smelting ore worth over \$50 per ton, and then to find that it had been attended with no better results than that two-thirds of the value of that prodigious production of rich metal should be found to have been swallowed up in expenses.

In conclusion, I must confess I am not a little puzzled over these results, and it is because I am desirous of obtaining a greater insight into mining expenses that I again call upon my fellow-shareholders to "One and All" attend the meeting on Monday next, and to consider the matter for ourselves, and here I tell them candidly the unless others who have a considerably greater stake in the concern than myself come forward and take a part I shall not stand alone, for the little stake I have in it would not seriously affect me if I were to lose it all.

W. K. S. M.

EMMA SILVER MINING COMPANY.

Sir,—As a shareholder, I cannot but regret that our Chairman has been induced to forward to the side cable messages embued with so much sensationalism; although containing no information whatever as to the permanent value of our property. To be told that the mine possesses "abundance of wealth" is equal to the statement made some time since, referring to another mine, that it was like "an Aladdin's cave, bedezired with jewels." Ignoring these flights of fancy, what a plain matter-of-fact man like myself really is anxious to know is—whether there is actually discovered ore in sufficient quantities to represent the present value of the company, to say nothing of the premium at which the shares are selling in the market. Taking into consideration the fact that the mine can only be worked eight months out of the twelve, and that the costs are, it may be presumed, at least 60 per cent. of the gross product, it is clear that to allow for contingencies the value of the ore already in sight should far exceed 2,000,000 sterling. This amount of ore is absolutely required for the shareholders, under the most favourable circumstances, to be able to receive a return in dividends equal to the paid-up capital (1,000,000). Therefore, the question which the Chairman would do well to put in his report should be—Is not it injurious to say that our Chairman is not practically acquainted with mines—the basis upon which, or by whom, the computation is made.

One thing has struck me as very strange in the sensational cable messages from our Chairman—the special announcement that he "did visit the bottom of the mine." From what little I know of the manner in which the Emma Mine is worked, and from a very careful perusal of the section, it seems to me that the only point from which any reliable opinion whatever can be formed as to the probable permanence of the mine is the deepest workings, which our Chairman has not seen. Another point which our Chairman should deal with in his report is to describe how a certain amount of first-class ore can be raised, and none of the second-class—this, to my mind, is next to an impossibility.

Explanations upon these several matters would be invaluable to those who, like myself, have no other means of obtaining the information except through the columns of your Journal.

A GLASGOW SHAREHOLDER.

Glasgow, Oct. 9.

THE UTAH SILVER MINES.

Sir,—In the Journal of July 20, under the head of "Advices from the Utah Silver Mines," it is reported—"Mining good carbonate ore on the first west extension of Dartmouth Mine, immediately over boundary of companies ground, on what is known as American Slag Mine, got right from owners. American Slag Mine is likely to be permanent. Discovered a body of carbonate ore in Stargis Mine; none hauled to surface yet." And in the Journal of Sept. 28 the report of the Utah Silver Mine runs thus—"Calculating capacity inadequate to the requirements of the smelting furnace; some carbonate ore must be purchased to supply the smelting furnace." Now, my fellow-shareholders may not be aware that Mr. Bateman, the vendor of the Utah Mine, has a large interest in the American Slag Mine, and hence their kind feeling in allowing us to work over their boundary into their mine. But as I have not heard that our own carbonate ore has been cut out

In either the Portland Mine or Sturgis Mine, why purchase what we have in our own mine in abundance?—London, Oct. 4.

ONE INTERESTED.

NORTH AMERICAN MINING COMPANY.

Str.—In my tour through Sierra County, California, some little time since, I paid a visit to the North American Mining Company, and I do not doubt for a moment the integrity of Mr. Morgan, who I learn is under the heavy salary of \$500 per month, but I am of opinion that the property and the product should not be left to one man; he is accountant, paymaster, receives the gold, and does the like business generally. Now, Mr. Editor, whatever confidence the directors might have in Mr. Morgan, who is an entire stranger to them, I think, for the well-being of the establishment and satisfaction of the shareholders, that there should be placed on the mines an English cashier and accountant, whose cheques and orders can be countersigned by the manager, and should also be present at the clean-up, weigh the gold in the presence of the manager and foreman, and see it entered into a book and signed by all three.

San Francisco, Sept. 16.

[For remainder of Original Correspondence see to-day's Journal.]

Royal School of Mines, Fergyn Street.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE LIV.—Continuing his notice of VENTILATORS, Mr. SMYTH said that one of the most ingenious machines of this kind was that of M. Lemielle, an eminent Belgian mining engineer. It was introduced about 20 years ago, and adopted at several Belgian and French collieries. In this country it was put up about 15 years ago at Ashton Vale, a small colliery near Bristol, and although objection was made to its great number of parts it has been at work ever since, acting with great efficiency, and without requiring any expensive repairs. Although Lemielle's ventilator had been long working in Belgium, it made no way in England until a few years ago, when some northern viewers visited that at Bristol, and formed a good opinion of it. The consequence was that several have been erected on a gigantic scale, and it is found capable of doing excellent service at a cheap rate (the expenditure of fuel being small), working at a slow speed, without being liable to get out of order. It consists of a large cylinder of brick, wood, or sheet-iron, within which a smaller drum is placed excentrically, and made to revolve. On the rim of the interior drum are three valves or shutters, which, by means of iron rods moving freely round an elbow axis in the centre of the large cylinder, lie close to the drum in one part of the revolution, and open from it in the other. These valves or shutters act on the same principle as the feathering paddles of a river steamer. The effect is that the air being admitted at the side, where the shutters lie close, it is driven in another revolution out through a prepared place of egress in the inner cylinder, by the expansion of the shutters. The other plan, much favoured by continental viewers, is that of M. Fabry, a mechanician of considerable note. This machine has two axes, each with three blades, which may be from 6 to 10 ft. broad, revolving in opposite directions, but towards each other. The blades have each a cross arm, so curved as to give close contact during revolution, and thus prevent communication from within to the external air. Above half the circumference of these fans fits closely within a casing of brick or wood, and the four air, when the machine is employed for exhaustion, is taken by the blades on approaching the lower part of their circuit of revolution, is carried on each side outward, and ejected on passing the upper limit of the curved casing. This machine also has the advantage of working at a slow speed, and displaces from 15,000 to 20,000 cubic feet of air per minute. Although suitable for many mines, we shall see that a much larger quantity of air must be passed where great areas have to be worked, and where fire-damp is prevalent.

It will be seen that by these means, and more particularly by the action of the furnace, plenty of air can easily be obtained, but having got it, the question is what to do with it? In round numbers it is reckoned that 100 cubic feet per minute is required for the health and comfort of each man—that is, 100,000 cubic feet per minute for 100 men; but, then, fire-damp is often given off at the rate of 200 cubic feet per minute, and it would require at least thirty times that amount of fresh air to dilute it to a harmless condition, or 6,000 cubic feet in addition. As the area worked and the liability to gas increases, and the number of men is multiplied, 40,000, or even 60,000, cubic feet per minute may be necessary in a mine simply for safety.

No system of pipes, which some well-meaning but ignorant persons have talked about, short of the levels themselves, could therefore circulate such vast bodies of air; and great velocity in the currents, it is obvious, must be requisite to carry the air through all the interminable ramifications of the passages, roadways, and workings. The proper distribution of the air, then, is a work of the highest importance, requiring a great amount of intelligence, experience, care, and attention. The great principle by which it is guided is one of much simplicity. If we take the plan of a colliery, we shall see that there are two shafts which come into play in ventilation, the upcast and the downcast. The air passed down the one will make its way by the nearest route to the other, and the proper ventilation of the whole of the mine depends upon the manner in which the air is prevented from taking the nearest and the shortest route, and made to go everywhere before it reaches the upcast. If the air is allowed simply to take its own course the ventilation will be very small, but in early times this was thought sufficient. A coal seam in Kilkenny, near the surface, was so worked, and when it was found impossible to go any further for want of air a fresh pit was sunk. The great means by which the air is made to go where it is wanted is by putting in stoppings, which may be either permanent, or doors to open and shut as wanted. For instance, we will suppose a pair of levels drive out from a shaft dividing with a bratticing by which one side is made the upcast and the other the downcast. When they have proceeded as far as possible a communication, called a thirling (which we will call X), is made between the two. The air from the downcast passes through it and along the other level it reaches the upcast, and a current is then established. The levels are then pushed forward until it becomes necessary to make a second thirling (Y), and when that is completed X is stopped up, and the current is obliged to go on as far as Y before it crosses to the return level. It is in this way that the air currents are made subservient to the necessities of distribution all through a large colliery. In bringing the mineral from the places of working to the foot, many of these stoppings may have to be passed through, and instead of a permanent walling, or other impediment to turn the air, a door is put in, which allows the wagons to pass, and then closes after them. There are in mines several classes of doors, which it may be as well to describe at once. They are—

1.—The "main-doors," which are used to cut off one part of a mine from another, so that the air current may not pass along too brief a course, and are of vital importance in ventilation. These are of considerable strength, and fitted with strong sills, so that in cases of explosion they may withstand the shock. If one of these doors should be blown away, or be left open by accident or negligence, the whole ventilation beyond that point will be neutralised. This is no theoretical danger, as unfortunately it happens too often, and some terrible explosions have been the result. An explosion at Talk-o'-the-Hill some years ago, by which many lives were lost, was caused by an accident happening to a wagon as it passed the main-door, which in consequence could not be closed. As a precautionary measure, they are generally put in pairs at a short distance from each other, which also prevents leakage. Thus, when one door is opened to admit of the passage of a wagon its partner is closed; and when the latter is reached and opened the first one is shut, the two acting like airlocks. A single door ought never to be trusted to, and in places of great importance they have as many as in the succession. The terrible results which accrue from these main-doors being blown away have led to the suggestion of—

2.—"Swing-doors." These are hung on hinges to the roof, fastened up, and not used at all in the regular work of the level; but the fastenings are so constructed with a sort of projecting fan-like latch that in the case of an explosion the blast would pass by the door without harming it, but would carry away the fastenings. The effect would be that the door would then swing down and take the place of the main-door, and the air would be driven through it. This is a very simple and effective plan for their lives away from the black-damp would be able to push the door open and creep through. Not so many of these have been erected as there ought to have been, and the more so as Mr. Buddle has a great opinion of their utility, and they had also the approval of the French engineers. At the last Exhibition at Paris specimens were exhibited which were said to have been used with advantage in the district of St. Etienne.

3.—"Sheth-doors" are lightly constructed of wood, and are used chiefly to check the air in the main air ways, and to turn it up to the workings when bratticings are used.

4.—"Dam-doors" are made air-tight, and are put in where they are troubled with spontaneous combustion. In some of the northern mines the small coal is extremely liable to this, and it occasionally happens that ordinary means will not suffice to extinguish the smouldering fire, which makes such a smoke and stythe that it can only be approached on the windward side. The dam-doors are then shut, and that portion of the pit entirely isolated until the fire, having no supply of air to support combustion, is gradually annihilated. Of course it is necessary to choose proper places to put them in, and these dam-doors in such cases do admirable service.

5.—There are mines in which what are called "sham-doors" are applied as regulators of the air.

6.—Then, in large collieries there are "man-doors," by which the overman, or his deputy, can get at the return air-ways without travelling enormous distances round for that purpose. They consist of small doors in the stoppings, just sufficient to let a man creep through, and should always be kept safely locked, and no one allowed to use them but the officers of the mine.

I should have mentioned with respect to the main-doors, situated as they are in the main thoroughfares, that it is necessary to have someone stationed at them to see that they are properly closed after the wagons have passed through, the drivers being especially apt to leave them open, to the great danger of the whole mine. This duty is performed by boys, and a great deal of exaggerated sympathy has been introduced as to the unhappy fate of these young trappers, who, however, never seem particularly unhappy, and are as ready and as lively at play as other boys. It has been proposed to introduce various ingenious self-acting contrivances, by which the approach of the wagons would open the doors, and again close them after the vehicles have passed. Plans like these, however well intentioned and ingenious, cannot provide against accidents, such as pieces of coal falling off the wagons, or the wagons themselves upsetting, and as the safety of all employed, and that of the mine itself, depends upon the proper opening and shutting of these doors, mechanical arrangements do not seem to have been much encouraged.

Besides doors, however, "stoppings," which I have already described, and "brattices" play an important part in ventilation. A brattice consists of a movable partition, put up so as to divide a level when the men are at work beyond the thirlings, or in making a thirling or cross-cut. It reaches from the roof to the floor, and the air is passed by a sheth-door out of the main air-way up one side of the brattice to the working end, and then passed down the other side to the main course. It is extensively used to bring the air up to the faces of coal during the time the men are at work. Brattices are often made by suspending a kind of tarpauling, called "brattice cloth," manufactured of great lengths and convenient widths for the purpose in Lancashire. It is, however, open to the objection of

being made of inflammable material. With that drawback, it is very useful, and in cases of explosion it may be run in with great facility, and so re-establish the division of the currents with great rapidity.

Then, lastly, it is necessary to establish "crossings" in order to carry one air-current over the other; and this, unless it is very well done, is apt to be a source of leakage and danger. A very unsatisfactory system prevails in some places of simply running a strong trough across, but any mechanical damage would break into it, in which case the intake air would turn and pass at once into the upcast current. The best way is to carry one level bodily over the other by means of a brick arch. In some cases the upper level is carried for safety several yards higher in the measures, and then, in case of explosion, the danger is escaped of bringing the current back. In certain mines in the neighbourhood of Wigan they put in arching of boiler-plate iron, strongly rivetted together. The necessity of guarding these crossings will become more apparent as we deal with the details of the distribution of air through the mines.

THE SOUTH MIDLAND INSTITUTE OF MINING, CIVIL, AND MECHANICAL ENGINEERS.

A monthly meeting was held at Wolverhampton on Monday, Mr. T. Ross, Vice-President, in the chair, in the absence of Mr. E. Jones, the President. Amongst the other members present were Messrs. Bromley, Davies, Watkins, Griffiths, Tatlow, Gilroy (North Wales), Austin, Naylor, Price, J. W. Hall (Bilston), Fenn, Tolly, Lees (secretary), and others. The following new members were elected:—Mr. W. V. Craig, Woodshutts Colliery, Kidsgrove; Mr. J. Strick, mining engineer, Hanley; and Mr. T. Fisher, Penn-road, Wolverhampton. A special vote of thanks was passed, on the motion of the Chairman, to the ironmasters of North Staffordshire, who had so handsomely entertained the members of the Institute on the occasion of their recent visit to that part of the country. Official reports were read by the Mining and the Mechanical committees respectively on the North Staffordshire works. Mr. Davies read the first. It was the joint production of himself and of Mr. Bromley. The document showed that the members were universally struck with the vast proportions and perfect symmetry of the gigantic head-gear erected by the Chatterley Company at their No. 4 pit, which is 260 yards deep. It was 63 feet in height, constructed of angle-iron and box-lattice girders, and appeared to the committee to be of most masterly construction. The shaft was provided with two sets of wooden conductors or guides, and two double-decked iron cages, carrying four tubs each time, and it was understood that the engine was capable of raising 50 per hour with each hand. Underneath the cages self-acting water-tanks were placed, capable of holding 500 gallons, or 2½ tons, of water. From this shaft the red shag and the red lime, as well as the oil shales, were worked. These mines were the uppermost of the North Staffordshire shales, which, according to accredited sections, were 41 in number comprising an aggregate thickness of 138 feet of coal measures, together with 12 intervening measures of ironstone, 8 of which had coal seams immediately underlying them. The signals from the bottom of the shaft to the engine-house were made by a bell, worked by electric agency. At the oilworks, near at hand, 65 retorts were in operation, manufacturing oil from shales associated with the blackband and red shag mines. These shales were similar to the Table Batt of South Staffordshire. At the oil refinery the Chatterley Company had erected very extensive apparatus for producing, from the crude oil obtained by the retorts just mentioned, oils for household uses, as well as the inferior oils and less fluid lubricants. The principle of economic utilisation of what might be termed an obnoxious waste, was here carefully and successfully carried out. The principle was the more striking at the Alum Works of Messrs. Bray and Thompson, which were capable of producing 60 tons of pure alum per week, mostly from the shales drawn from the mines of the Chatterley Iron Company. The committee reviewed other objects of interest, including Craig and Biddler's magnetic lock, Biddler's hydraulic coal-getting machine, and Dr. Irvine's lamp. Mr. Watkins read the report of himself and Mr. J. T. Tatlow, who were the acting mechanical committee. The document contained much descriptive and critical information. The committees were thanked for their services and their reports.

The discussion of the paper on the "Correlation of the Coalbrookdale and South Staffordshire Coal Fields" was postponed, owing to the absence of Mr. Daniel Jones, the author of the paper. The members then examined a model, shown by Mr. Herbert Gibbs, of Penn Fields, Wolverhampton, of King's patent apparatus for preventing overwinding, and also accidents from the breaking of the drawropes, or chains, by which the skips or cages are brought up the shafts. The invention is of very great excellence, and is not unknown to the mining world generally, though it is insufficiently known in South Staffordshire. Mr. Gibbs has a part interest in the patent, and has the exclusive right to its letting throughout Staffordshire and Shropshire, and some other counties. The engineers experimented with the model, and were impressed with the effectiveness of the mechanical arrangements whereby the effects desired were secured. The President said that when the Institute of Mechanical Engineers visited Derbyshire they saw the invention in use, and for their information it was fully tested with loaded cages and the like. It worked completely, and the manager of the extensive Butterley Company, who had applied it to all the pits of that concern, told the Institute that it had never failed. Mr. J. W. Hall reminded the members of the South Midland Institute, after January, every shaft more than 50 yards deep would have to be provided with guides. Mr. Gibbs was thanked, and was asked to attend the next meeting of the Institute, to furnish still further information than he was then prepared to offer.

DUDLEY MINING INSTITUTE.

An ordinary monthly meeting of members was held at Dudley, on Monday, Mr. HENRY JOHNSON (the President) in the chair. There were also present—the Vice-President, Mr. Blakemore; Messrs. J. M. Fellows, D. Peacock, J. Field, T. Latham, W. Spruce, T. Brettell, J. Hughes, T. Lloyd, J. S. Whittier, J. M. Fellows, J. Llewellyn, D. Rogers, and about twenty others. The President said the first business of the evening was to discuss the Mines Regulation Bill, in order that all might thoroughly learn its provisions and their duties by the time it came into operation on Jan. 1 next. He had seen Mr. J. P. Baker, Her Majesty's Inspector, and had formally asked him who the "Manager" was to be under the new Act. After some hesitation, Mr. Baker said it was neither the doggy, the chartermaster, nor the mine agent, but a special person to be appointed with the name of manager. He would have the whole of the management of the pit and its ventilation. Where, however, less than 30 persons were employed in a pit it was discretionary on the part of the Government Inspector whether a manager was necessary or not. A manager was not required in each pit if he could walk uninterruptedly along the whole face of "work" worked by two pits. In a pit where this could not be done a separate manager would be required for each seam. Mr. Baker also told him that he regarded the words "every mine" as meaning every seam of coal or ironstone in each pit, and that a separate "manager" must be appointed for each seam if more than 30 persons are employed, or 25 tons of mineral raised per day.

Mr. Spruce enquired how the Act stood in the case of a man who was getting brooch coal and white stone? The President replied that the Act, in his opinion, required a manager for each pit. Mr. Hartshorne said the same rule which spoke of less than 30 persons working in the mine also said "or raising less than 25 tons." Did that mean 25 tons of coal, or coal and waste? The President said there was no doubt but it meant salable coal. The next question he wished to call their attention to was the clause regulating the employment of boys. All owners who wished to hire lads for thin seams, or for the "holing" in the thick coal, were compelled to give notice to the Home Secretary, and it had better be done at once. Mr. Fellows said the Act said that the owner might be the manager. The Vice-President said he might, by taking all the responsibilities, and giving notice. He did not think many owners would take the post. The butty might be the manager, he ceased to be butty. The President then referred to a clause which said the inspection of the mine was to be every 24 hours, and where no gas had been seen for 12 months it was not necessary that the pit should be explored with a safety-lamp. It was well known that there were pits where no gas had been seen for more than 12 months, and the next morning it would be certain destruction to go down without a safety-lamp. He, for one, did not understand such a clause.

The President then called attention to the following clause:—"Before Jan. 1 every owner or agent must nominate himself, or some other person (not being a contractor for getting the mineral in such mine, or a person in the employ of such contractor) to be the manager of the mine, or of such part of the mine as may be divided or separated, and he must give notice of his nomination to the Inspector by post to the Inspector of the name and address of such manager. No person is qualified to be a manager unless he is registered as the holder of a certificate under the Act." Mr. Peacock said the members had received a short account of the Act from Mr. Pease, and at the end of the month a full and complete exposition would be published. He thought it would be wise to defer the discussion on the subject until that book was published. The Institute was well up in funds, and he begged leave to propose 200 copies of the book should be purchased by the secretary (Mr. Henry Johnson, jun.), and distributed to the members. Mr. Blakemore seconded the proposition, which was carried unanimously.

The President, referring to the recent experiments in Sandwell Park with the new explosive compound "dynamite," said he proposed giving a description of the destructive agent. The powder was the most powerful blasting compound known, and was safer than all others. A keg of it might be thrown from any height, or placed on a fire, without fear of explosion, because the compound would only explode by means of a percussion cap. It had greater effect upon blocks of cast or wrought iron than it had upon rocks; in fact, the harder the material the better the dynamite did its work. It had great advantages, too, on the score of economy. Smaller bores and fewer holes were required than with gunpowder. In the winter, when the powder was frozen, it would not melt, but a small amount of warmth would soon restore its properties. It was, therefore, a good plan for the workman to carry his store of cartridges in his pocket. For clearing land, quarrying, and for all underground work nothing could be better. Although dynamite was so safe the railway companies would not carry it, and he had to have the material carted all the way from Glauber to Sandwell Park collieries. The shots had been used at the bottom of the shaft, and the men praised the speed with which the powder did its work. He might mention, incidentally, that the sinkers were now more than 12 yards below where the seam of coal was found, and still in the white stone rock (specimens were exhibited). Several experiments were then made in the room. A cart-ridge containing the dynamite was emptied on the fire, and it slowly burned away like so much sawdust. When it was utterly consumed the cap was placed in the fire, and exploded with a sharp report. Many members expressed their faith in the new material. Mr. Henry Hughes, ironmaster, Wood Setton, was then elected a member. The business concluded with the exhibition of King's patent for preventing loss of life in pit shafts by broken chains or by overwinding, exhibited by Mr. Gibbs, of Wolverhampton, and appeared to be well received.

Meetings of Mining Companies.

GREAT LAXEY MINING COMPANY.

The annual general meeting of shareholders was held at the Imperial Hotel, Douglas, Isle of Man, on Wednesday, Mr. G. W. DUMBLELL in the chair.

There were also present Messrs. Broadbent, P. Watson, J. Spittal, C. Cleaton (directors), Drs. Thomson and Ring, Capt. McGregor and Rowe, P. Bridson, W. Stephenson, J. Cubbon, L. G. Howard, T. Wilson, W. Bery, R. Lomax, J. Lee, H. B. Noble, W. Gell, P. L. Garrett, Kaye, R. Sherwood, &c. The CHAIRMAN said the notice under which the meeting was called stated that the accounts would be laid before the meeting, and the appointment of directors and auditors for the ensuing year would take place—the retiring directors and auditors being eligible for re-election. They would first take the report of the directors, which was as follows:—

Since the half-yearly meeting of the company in April last the attention of the directors has been fully and continually occupied on behalf of the shareholders, to an extent hitherto quite unknown since the formation of the company. At the time of that meeting the directors were engaged in a question with the department of Her Majesty's Woods, &c., as to the terms upon which a new lease would be granted to the company. The terms then proposed involved a kind of partnership, whereby the Crown would be entitled to participate to the extent of a third part of the profits of the mine beyond a limited sum of 10,000l. per annum. The principle involved in those terms appeared to the directors so objectionable that they appealed to the Treasury, and were enabled, after great trouble, to have the terms, so far as the question of profits was concerned, done away with, and in the month of May the Lords of the Treasury directed a new application to be sent to Mr. Howard for terms. An application was accordingly made, and Mr. Howard, in lieu of his former proposal of 1-12th royalty on lead and a portion of profits, proposed that there be a royalty on lead of ½. The directors considered a royalty of ½ so severe, and so entirely beyond anything they have ever heard of, that, finding Mr. Howard determined on the point, they again appealed to the Treasury for relief, but after some time received a reply that the Treasury refused to interfere any further in the matter; and, having received an intimation from Mr. Howard strictly limiting a time before which his offer must be accepted, the directors were compelled reluctantly to accept Mr. Howard's terms in respect of the royalty proposed. The directors have never heard of such a heavy royalty being exacted, and they believe a similar instance never has occurred, notwithstanding that it is greatly preferable to the terms previously offered. The next subject to which the directors refer is the strike of the underground men at Laxey for an advance of wages, and which has caused the work to be suspended for the last four months. The directors desire in this report to give you as briefly as possible a summary of the proceedings herein, and which they hope will be much more fully detailed to the shareholders at the meeting.

On Friday, June 7, the directors received a copy of a resolution passed at a meeting of the miners the night before requiring an advance of wages of 4s. a week for miners and labourers and all other "underground men," and giving notice that if it did not accede to their demand they would strike on Monday morning following. The demand was peremptory, and the instant reply deprived the directors from the opportunity of consulting with anyone. The directors refused to comply with the demand, and the men accordingly ceased to work. It would make this report too lengthy if the directors attempted to refer minutely to all the communications between the directors and the workmen, which shall be laid before the shareholders, but the directors became convinced that the working of the mine had been greatly mismanaged, that whilst men might complain that they were not always paid at once the whole amount made by their month's "bargain," yet the directors had much greater cause to complain that men were continually paid for work they had not done, and that whilst, on the one hand, the debt to the men was always paid, yet the debts from the men to the company for work not done, as a rule, was never paid; and it does appear that instead of the workmen having cause to complain, as they led the directors to suppose, they have been systematically receiving wages they knew they had not earned, and although those wages represented an average exceeding all other mines in the island, many of the men had received money in addition to the wages apparently paid them. In fact, it does appear that instead of the workmen's just cause of complaint, they have participated in a system of injustice most injurious to the mining company, and which, without this "strike," would have gone on for an indefinite period. The directors came to the conclusion that a new start might be made, and that the influence and power of the managers having been disposed of, and Captain Redcliffe having entered upon the duties of second captain, in the place of Captain Barrell, all could be satisfactorily arranged by setting new bargains to the men upon fair and equitable terms, and the question was to obtain the services of some one to perform this duty in whom the men were likely to place confidence, and who must have a knowledge of the nature of the ground in the mine, and the directors fixed upon and engaged the services of Capt. John Kitto, formerly an underground agent at Great Laxey, and on the 2nd of August a printed circular was issued by the directors giving the men notice that on Tuesday following (the 6th August), Capt. John Kitto and Capt. Redcliffe would "attend at the mine for the purpose of valuing the ground and settling the bargains." The men were invited to "meet Capt. Kitto when viewing and valuing the ground, and in order that the bargains may be set at fair prices." By this means the directors expected that all prejudices of the men would be removed, and a just and fair arrangement come to between the company and the workmen. On the 6th August a written authority was given to Capt. Kitto, and he was expressly cautioned by the directors that his duty was confined to settling the "bargains," and that he was not to interfere with the question of labourers' wages. Capt. Kitto went to Laxey, and was persuaded to attend a great meeting of the workmen, where he states he was forced into signing an agreement prepared by the men, containing a variety of terms and stipulations, many of which the entire working of the mine underground was placed under the control of the men, completely superseding any manager.

After this Capt. Kitto proceeded to set the bargains in the mine. On the following day, whilst Captain Kitto was at Laxey, the directors having heard of the proceedings, immediately gave Capt. Kitto notice that while they would confirm the bargains he had set they were bound to repudiate the agreement he had signed. Capt. Kitto immediately replied—"I was quite prepared for your letter, and for the astonishment expressed therein at the document I had signed; but I did this as a last resource and entirely on my own responsibility, and could be further from my mind than that you or any other board of directors would repudiate or confirm such proceedings." Capt. Kitto, in the same letter, speaks of the paper writing as "the signing of this precious document, which is only so much waste paper, as it was signed without the least authority from you or any of the directors, and I shall only expect you to confirm the letting of the bargains, and to which I am quite sure you will not object." The men had resumed work in the mine, but the directors could not permit them to suppose the agreement extracted from Capt. Kitto was accepted by the directors, and accordingly Capt. Kitto wrote to undeceive them, and they at once forsook their work, and "broke the bargains," which they admit would pay them well. Capt. Kitto's correspondence with the directors subsequent to this date will be laid before the meeting. From that period the men have continued on strike. Numerous publications and circulars have issued from them, principally seeking to bully and abuse the directors, and to create a spirit of animosity in the minds of the shareholders against the directors, evidently expecting that in the struggle which might ensue they would obtain some advantage. During this long period the directors have been assailed by anonymous writers with an amount of scurrility which does not do credit to the pages of any newspaper. It must be manifest to all persons to all persons that the directors could not enter into these nameless libels, but are satisfied to afford a reply to the shareholders at this meeting. It must be left to the shareholders to decide whether the abusive, dictatorial tone assumed by the leaders of the men on strike towards the directors is such as ought to be adopted by any class of workmen towards their masters. The written statements of the men to be laid before the meeting will prove that they have been offered all they asked for, and their only pretence for standing out now is as to the payment of the labourers, for which they propose that either the company shall pay the labourers at the office whatever sum the miners choose to direct, or that the directors refuse both these proposals; they will then as they think proper. The directors refuse both these proposals; they will not recognise on the company's books more than at the rate of 15s. a week; but if by extra work they can satisfy the bargain taken to pay them beyond that, let them do so. The directors have nothing to say to that, such an opening may be beneficial to both parties; but, under any circumstances, the labourers will be sure to receive settled wages from the company. The directors decline the proposition to put the labourers into the power of the miners to pay their wages, because, when formerly the system existed, the labourers were not fairly dealt by, and had great difficulty in getting their wages from the miners, and sometimes did not get paid. It was to obviate this abuse of power by the miners that the company determined to pay the labourers. The directors have to some extent referred to the mismanagement of the mine, and the mode of paying away money not earned. Accounts embodying a portion of these affairs will be laid before you; they have been open to the inspection of Capt. Rowe, and his reply in justification of the course pursued will be also before you for consideration. It cannot be a pleasant duty for the directors to part with a manager who has held that position for the last 25 years, and who has always been considered eminently well qualified for the duties he had to perform. The directors feel much to say that the money of the company appears to have been most improperly paid away by Capt. Rowe, but they are equally bound to say that they do not find that such money has got into Capt. Rowe's pocket. Everything alleged against Capt. Rowe has been most carefully examined and investigated. It was quite impossible for Captain Rowe to remain manager of Great Laxey, and he very properly resigned. The history of events referred to in this report, painful and onerous as it shows the duties cast upon the directors to have been, convey in truth but a very imperfect idea of the constant care and anxiety which has pressed upon them. It is more agreeable now to look forward in a few words to the future of the mine, and to arrange to make considerable improvements in working both above and below ground. Capt. Redcliffe, who has been appointed second captain in the room of Capt. Barrell, has entered the employ with excellent testimonials, and is expected to be a very valuable agent.

Capt. Joseph Ball has been appointed surface agent and head washer, having the entire control of the washing-floors, the management of which has been frequently complained of. We are assured that Capt. Ball has not only a thorough knowledge of the washings, but also great aptitude in dealing with machinery, and is now erecting improved machinery for the dressing of ores which we are assured will effect an immense saving in manual labour, and give an increased produce of ore from the same bulk of stuff; and, lastly, the directors have secured the services of Capt. Polglase as head manager of the mine, who we believe to be eminently qualified to perform the duties of the situation, and we expect him to commence work on Nov. 5 next. The directors are happy to say that the mine, both at surface and underground, is in excellent order and repair, and a statement to the contrary effect published in a paper called the *Mining World*, of Sept. 28, is utterly false and untrue. In closing their report the directors beg to assure their fellow shareholders that they deeply sympathise with them in the suspension of the works of the mine, and the non-payment of dividends, but they do expect that the alterations taking place at Great Laxey will eventually repay all the anxiety that has been occasioned.—GEORGE W. DUMBLELL, JAMES SPITTALL, C. CLEATON, FRED. BROADBENT, PETER WATSON.

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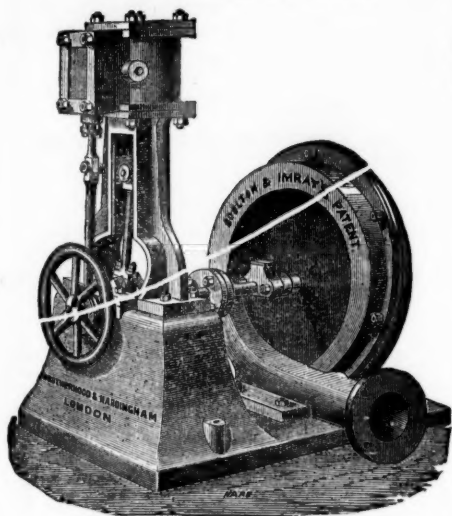
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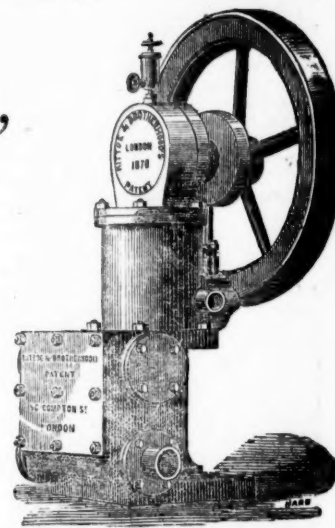
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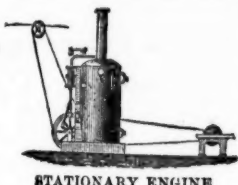
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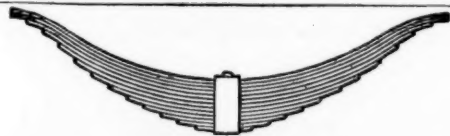


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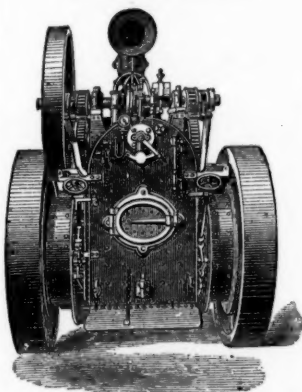
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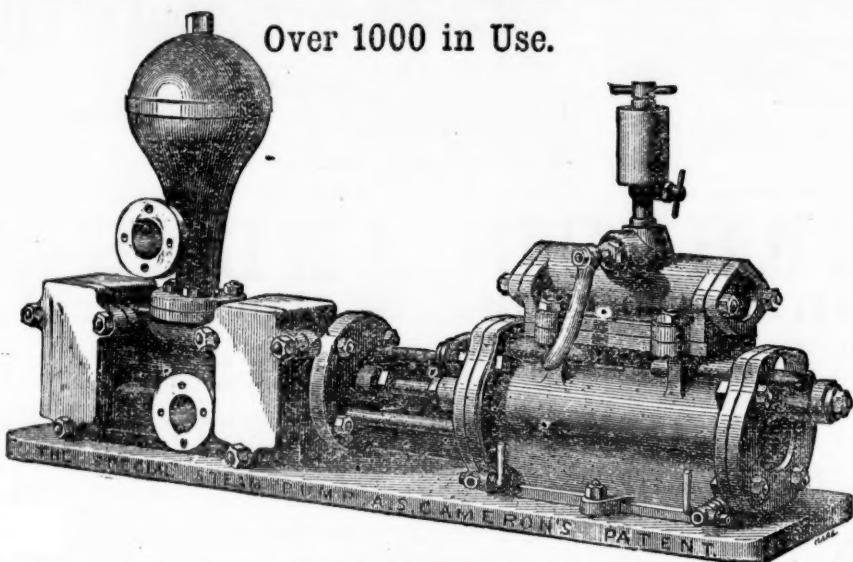
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Simple, Durable, Economical.

IN USE AT THE FOLLOWING COLLIERIES:—

Adelaide Colliery, Bishop Auckland ...	3 Pumps.	North Bitchburn Colliery, Darlington ...	2 Pumps.	Stott, James, and Co., Burslem ...	1 Pump.
Acomb Colliery, Hexham ...	1 "	Newton Cup Colliery, Darlington ...	1 "	Seaton Delaval Coal Company, near Newcastle	1 "
Blackfell Colliery, Gateshead ...	1 "	Normanby Mines ...	1 "	Taornley Colliery, Ferryhill ...	1 "
Black Boy Colliery, Gateshead ...	1 "	Oakenshaw Colliery ...	1 "	Thompson, John, Gateshead ...	2 "
Castle Eden Colliery ...	2 "	Pease's West Colliery ...	2 "	Trimdon Grange Colliery ...	1 "
Crofton, J. Ct., near Ferryhill ...	1 "	Pease, J. and J. W., near Crook ...	5 "	Tudhoe Colliery ...	4 "
Carr, W. C., Newcastle ...	4 "	Pease, J. and J., Brandon Colliery ...	1 "	Vobster and Mells Colliery ...	2 "
Etherley Colliery ...	1 "	Pegwood Colliery, near Morpeth ...	2 "	Widdington Colliery, Morpeth ...	2 "
Gidlow, T., Wigan ...	3 "	Pelton Fell Colliery ...	1 "	Whitworth and Spennymoor Colliery ...	3 "
Haswell, Shotton, and Easington Coal Co.	2 "	Railley Fell Colliery, Darlington ...	1 "	Westerton Colliery, Bishop Auckland ...	1 "
Lochgelly Iron and Coal Company ...	1 "	Right Hon. Earl Durham, Fence Houses	1 "	Wardley Colliery, Gateshead ...	1 "
Leather, J. T., near Leeds ...	2 "	Skelton Mines ...	1 "	Westminster Brymbo Coal Company ...	2 "
Lumley Colliery, Fence Houses ...	1 "	South Beaulieu Colliery ...	4 "	Weardale Coal and Iron Company ...	5 "
Monkwearmouth Colliery, Sunderland...	1 "	St. Helens (Tindale) Colliery ...	1 "		

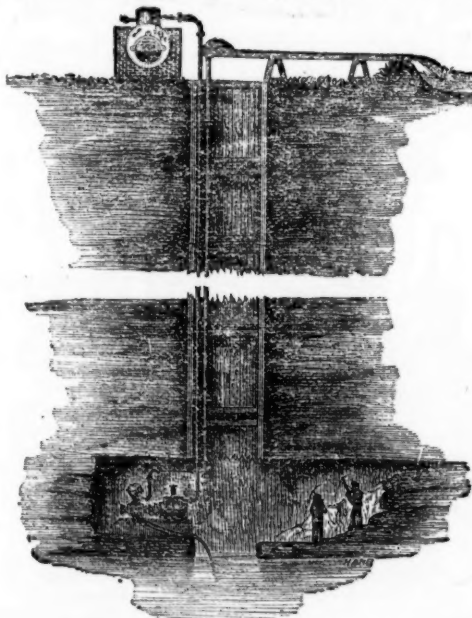
IRONWORKS AND ROLLING MILLS:—

Bede Metal Company, Jarrow ...	11 Pumps.	Gilkes, Wilson, Pease, and Co., Middlesboro' ..	2 Pumps.	Whitwell and Co., Stockton ...	3 Pumps.
Bagnall, C. and T., Grosmont Ironworks	2 "	Lloyd and Co., Middlesborough ...	1 "	Whessoe Ironworks, Darlington ...	1 "
Consett Ironworks ...	2 "	Solway Hematite Iron Company, Maryport ...	1 "	West Cumberland Hematite Iron Company ...	1 "
Castleford Foundry Company, Normanton	1 "	Vaughan, Thomas, Middlesborough ...	2 "	Westbury Iron Company ...	1 "
Ellen Rolling Mills, Maryport ...	1 "	The Shotts Iron Company, Edinburgh ...	1 "		

THE "SPECIAL" STEAM PUMP AS APPLIED FOR DRAINING MINES.

The arrangement in the accompanying illustration shows an economical method of draining mines without the expense of erecting surface-engines, fixing pump-rods, or other gearing. A boiler adjacent to the pit's mouth is all that is necessary on the surface; from thence steam may readily be taken down, by means of a felted steam-pipe, to connect the pump with the boiler. The pump may be placed in any situation that may be convenient for working it, and connecting the steam, suction, and delivery pipes.

These engines can be fixed and set to work in a



comparatively short time, and also at a very small outlay. They are used in large mines as auxiliary engines, and will be found invaluable adjuncts in all mining operations.

To estimate the quantity of water to be raised by any given size of pump refer to the tabulated list below. It is recommended to use long-stroke pumps where the height exceeds 100 ft., so that the largest result may be obtained with a minimum wear and tear of the pump pistons and valves. The pumps are provided with doors for ready access to all working parts.

PRICES OF THE "SPECIAL" STEAM PUMPS.

Diameter of Steam Cylinder	2 1/2	3	4	4	6	6	6	7	7	7	8	8	8	8	10	10	12	12	14	16	26
Diameter of Water Cylinder	1 1/2	1 1/2	2	4	3	4	6	5	6	7	4	6	7	8	6	7	8	10	8	7	6 1/2
Length of Stroke	6	9	9	12	12	12	12	12	12	12	12	12	12	18	12	12	18	24	48	24	72
Strokes per minute	100	100	70	50	50	50	50	50	50	50	50	50	50	35	50	50	35	—	—	—	—
Gallons per hour	310	680	815	2250	1830	3250	7330	5070	7330	9750	3250	7330	9750	13,000	7330	9750	13,000	—	—	—	—
PRICE.....	£10	£15	£20	£35	£30	£40	£47 10	£50	£52 10	£57 10	£50	£55	£65	£85	£70	£80	£100	—	—	—	—

IF BRASS LINED, OR SOLID BRASS OR GUN-METAL WATER CYLINDERS, WITH COPPER AIR VESSELS, EXTRA, ACCORDING TO SIZE.

Any Combination can be made between the Steam and Water Cylinders, provided the Lengths of Stroke are the same, thus—8 in. Steam and 3 in. Water, or 10 in. Steam and 3 in. Water, adapted to height of lift and pressure of steam, and so on.

TANGYE BROTHERS & HOLMAN, 10, Laurence Pountney-lane, London, E.C.